Curriculum Book

and

Assessment and Evaluation Scheme

based on

Outcome Based Education (OBE)

in

Master of Science (Agriculture)

In

Agronomy

2 Years Degree Program

Revised as on 01 August 2023
Applicable w.e.f. Academic Session 2023-24

AKS University

Satna 485001, Madhya Pradesh, India

Faculty of Agriculture Science and Technology
Department of Agronomy

AKS University

Faculty of Agriculture Science & Technology

Department of Agronomy

Curriculum & Syllabus of M.Sc. (Agronomy) program

(Revised as on 01 August 2023)

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AKS University, Satna

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Vice chancellor

Professor B.A. Chopade
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AKS University

Department of Agronomy

Faculty of Agriculture Science and Technology

Curriculum &Syllabus of Agronomy program

(Revised as on 01 August 2023)

Forwarding

I am delighted to observe the updated curriculum of the Department of Agronomy for M.sc Ag in Agronomy Program, which seamlessly integrates the most recent trends and corporate affairs in the field of Agronomy and adheres to the guide lines set forth by ICAR The revised curriculum also thoughtfully incorporates the directives of NEP-2020.

The alignment of course outcomes (COs), Programme Outcome (POs) and Programme specific outcomes (PSOs) has been intricately executed, aligning perfectly with the requisites of NEP-2020 and NAAC standards. I hold the belief that this revised syllabus will significantly enhance the skills and employability of our students.

With immense satisfaction, I hereby present the revised curriculum for the MBA program for implementation in the upcoming session.

ER. Anant Soni
Pro Chancellor &Chairman
AKS University, Satna

01August 2023

AKS University

Department of Agronomy

Faculty of Agriculture Science and Technology

Curriculum &Syllabus of Agronomy program

(Revised as on 01August2023

From the Desk of the Vice-Chancellor

AKS University is currently undergoing a process to revamp its curriculum into an outcome based approach, with the aim of enhancing the teaching and learning process. The foundation of quality of quality education lies in the implementation of a curriculum that aligns with both societal and industrial needs, focusing on relevant outcomes. This entails dedicated and inspire Faculty members, as well as impactful industry internships.

Hence, it is of utmost importance to begin this endeavor by crafting an outcome-based curriculum in collaboration with academia and industry experts. This curriculum design should be informed by the latest technological advancements, market demands, the guidelines outlined in the National Education Policy (NEP) of 2020, and sustainable goals.

In the curriculum, I am pleased to observe that the Agronomy Department has diligently adhered to the future prospects of the agriculture science. To achieve excellence in the curriculum planning pertaining to agriculture by periodically updating it in order to provide to students with sound technical knowledge of outcome based education and to strengthen the research activities in agriculture science by under taking innovative approaches for the developing the field of agriculture. This curriculum will be beacon of light particularly to the student of agriculture science job/Career prospects in the field of teaching, research and extension activities in either Government or Private sector.

I am confident that the updated curriculum for agriculture will not only enhance student's technical skills but also contribute significantly to their employability during the process of revising. This curriculum has been adopted as par the guideline of ICAR PG Restructuring Committee

Curriculum revision in an ongoing and dynamic process designed to address the continuous evolution of technological advancement and both local and global concerns. AKS University warmly invites input and suggestion from horticulture experts researchers and alumni students to enhance the curriculum and make it more students cantered your valuable insights will gently contribute to shaping as education that best serves the needs and aspirations of the students.

01August2023

Professor B.A. Chopade
Vice-Chancellor
AKS University, Satna

Preface

As part of our commitment to ongoing enhancement, the department of agriculture consistently reviews and updates its M.Sc. (Ag.) Agronomy programme curriculum every four and two years. Through this process, we ensure that the curriculum remains aligned with the latest technological advancements, as well as local and global industrial and social demands.

During this procedure, the existing curriculum for the M.Sc.(Ag.) Agronomy programme undergoes evaluation by a panel of technocrats, industry specialists, and academics. Following meticulous scrutiny, the revised curriculum has been formulated and is set to be implemented starting from August 01, 2023. This implementation is contingent upon the endorsement of the curriculum by the University's Board of Studies and Governing Body.

This curriculum as per guidelines of Restructured and Revised Syllabi of Post-graduate Programmes of ICAR. In order to foster the holistic skill development of students, a range of practical activities, including Hands-On Training, Industrial Visits, Project planning and execution, Thesis Writing, Seminars, have been incorporated.

To ensure a comprehensive learning experience, detailed evaluation schemes and rubrics have also been meticulously provided.

For each course, a thorough mapping of Course Outcomes, Program Outcomes, and Programme Specific Outcomes has been undertaken. As the course syllabus is being meticulously developed, various elements such as session outcomes, laboratory instruction, classroom instruction, self-learning activities, assignments, and mini projects are meticulously outlined.

We hold the belief that this dynamic curriculum will undoubtedly enhance independent thinking, skills, and overall employability of the students.

Dr. S.S. Tomar
Dean
Faculty of Agriculture Science & Technology
AKS University,Satna

01August 2023

AKS University

Faculty of Agriculture Science and Technology
Department of Agronomy

Introduction

The faculty of Agricultural Science and Technology at AKS University has been a pioneer in promoting agricultural education and research. Among its various departments, the department of Agronomy holds a significant position. Established in 2014, this department has played a crucial role in advancing the field of Agronomy through its dedicated focus on teaching, research, and extension activities.

At the heart of its existence is the commitment to imparting knowledge and skills to students pursuing agricultural sciences. The Department of Agronomy offers comprehensive academic programs that equip students with the theoretical foundations and practical expertise required for successful careers. Through rigorous coursework and hands-on training, students gain insights into crop production systems, soil management techniques, weed control strategies, and sustainable farming practices.

The Department of Agronomy at AKS University stands as a testament to its unwavering commitment to advancing agricultural sciences. As it continues to evolve with changing times, the department remains dedicated to nurturing future generations of skilled agronomists who will contribute towards global food security and sustainable farming practices.

Vision –

Enhance the knowledge about the innovative technology for increasing the crop production and boost up the Indian economy. Promoting the responsible, ethical use and management of air, water, soil, plant and animal resources including sustainability in agricultural practices are vision of department of agronomy.

Mission

M-1: The mission of the department of agronomy is to advance understanding of the biology of agronomical crops and their interactions with soil. The faculty focuses on all aspects of the production technology of various crops.

M-2: The department provides experiential educational and research opportunities to prepare the next generation of scientists and global citizens to be competent in resolving the complex challenges of the 21st century and in providing a healthy and secure food supply while protecting our environment.

M-3: In order to become a dynamic and effective future leader in agronomy, one must develop an interdisciplinary global perspective. The department aims to strengthen the economy and quality of life for society by developing human resources, technologies, and products.

M-4: it is our aim to be a world leader in research, teaching, and extension involving plant health while serving the changing needs of society, the environment, and the university.

AKS University

Faculty of Agriculture Science and Technology

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PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO-1
Imparting subject-related knowledge along with developing a connection between practical solutions and theory

PEO-2
Generate knowledge through training in cognitive, affective, and psychomotor, which are necessary for productive research in a selected area of crop agronomy

PEO-3
To enhance visibility and impact of post graduate programs in agricultural sciences and students will be trained various pathways for manifesting their objectives in carrier of the students.

PEO-4
Ability to obtain impact of professional activities in agriculture for improvement of socio-economic condition of the farmers.

PEO5:
To become a face among the farming community through providing support in advance cropproduction technologies.

PROGRAM OUTCOMES (POs)

PO-1
Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India.

PO-2
Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.

PO-3
Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.

PO-4
Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part of agriculture.

PO-5
Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.

PO-6
Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.

PO-7
Student will apply various statistical methods to analyze their master research work

PO-8
Student will apply basic concepts in laboratory techniques during their research work

PO-9
Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.

PROGRAMME SPECIFIC OUTCOMES (PSO_S)

PSO-1
Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.

PSO-2
Acquainting with basic concepts theories and terminology of Agronomy.

PSO- 3
To undertake teaching research and extension activates along with administrative and consultancy services.

PSO- 4
Apply research and expertise in resolving the problems of existing farm in the periphery of universities.

PSO- 5
To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

Consistency/Mapping of PEOs with Mission of the Department

PEO	M1	M2	M3	M4
PEO1	2	3	3	3
PEO2	2	3	2	3
PEO3	1	2	2	3
PEO4	2	2	3	3
PEO4	1	2	3	2
PEO5	3	2	3	1

1*: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) 4: No correlation*

GENERAL COURSE STRUCTURE & THEME

1. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

2. Range of Credits:

In the light of the fact that a typical Model Two-year Post Graduate degree program in Agricultural has about 74 credits, the total number of credits proposed for the Two-year M.Sc. Ag Agronomy is kept as PG Restructuring Committee for ICAR considering NEP-20 and NAAC guidelines.

Components of the Curriculum

(Program curriculum grouping based on course components)

Sl No	Course Component	Total Credits	Percentage of total credits in the Program
1	Program Core (PCC)	22	29.73
2	Minor courses (PEC)	09	12.16
3	Supporting Courses (PSC)	07	9.46
4	Research Project(s) (PRC)	15	20.27
5	Industrial Training/Internships (ISC)	00	0.00
6	Seminar (SC)	16	21.62
	Total Credit		
6	**Any other (PlSpecify)Non-Credit(NC)**	**05**	**6.76**
7	Entrepreneurship (EC)	00	00
Total Non-Credit		**74**	**100**

General Course Structure and Credit Distribution

Curriculum of M.Sc Ag Agronomy

Semester -I		Semester -II	
Course Title	**Credit**	**Course Title**	**Credit**
Major Courses		**Major Courses**	
1. Modern Concept In Crop Production	3+0+0= 03	1. Principles and Practices of weed Management	2+0+1 = 03
2. Principles And Practices Of Soil Fertilityand Nutrient Management	2+0+1= 03	2. Principles and Practices of Water Management	2+0+1 = 03
3. Agronomy Of Major Cereals And Pulses.	2+0+0 = 02	3. Principles and Practices Of Organic Farming	2+0+1 = 03
4. Cropping System and sustainable Agriculture	2+0+0 = 02	4. Dryland farming and Watershed Management	2+0+1 = 03
Minor Courses		**Minor courses**	
5. Soil Biology and Biochemistry	2+0+1 = 03	5. Principles Of Plant Physiology	2+0+1 = 03
6. Soil, Water and Air Pollution	2+0+1 = 03	--	
Supporting Courses		**Supporting Courses**	
7. Statistical Methods in Applied Science	3+0+1= 04	6. Experimentaldesign	2+0+1 = 03
Non-Credit Compulsory Courses		**Non-Credit Compulsory Courses**	
8. Library And Information Services	0+1+0 = 01	7. Intellectual Property And Its Management In Agriculture	1+0+0 = 01
9. Technical Writing and Communications Skills	0+1+0 = 01	8.Basic Concepts In Laboratory Techniques	0+0+1 = 01

Total Credit	**22**	**Total Credit**	**20**
Semester -III		**Semester -IV**	
Course Title	**Credit**	**Course Title**	**Credit**
Research			
Master's Research	0+15=15	Master's Research seminar	0+15=15
Master's Seminar	0+1=1		
Non-Credit Compulsory Courses			
Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1		
Total Credit	17	**Total Credit**	**15**

1. Program Core (PCC)
2. Supporting Courses (PSC)
3. Research Project(s) (PRC)
4. Industrial Training/Internships (ISC)
5. Seminar (SC)
6. Any other (Pl Specify) Non-Credit (NC)
7. Entrepreneurship (EC)

Total Credit: 74

Course code and definition:

L = Lecture

T = Tutorial

P = Practical

C = Credit

Course level coding scheme:

1. **Professional core courses** = PCC
2. **Professional elective** =PEC
3. **Supporting Courses** =PSC
4. **Research Project(s)** =PRC
5. **Industrial Training/Internships** =ISC

6. **Seminar** =SC
7. **Any other (PlSpecify) Non-Credit** = NC
8. **Entrepreneurship** =EC

Three-digit number used as suffix with the Course Code for identifying the level of the course. Digit at five hundred's place signifies the year in which course is offered. e.g. 501,502 etc. for course code.

Category-wise Courses

PROFESSIONAL CORE COURSES [PCC] / Major Course (Total 20)

Sl.	Code No.	Subject	Semester	Credits
1	Agron501	Modern Concept in Crop Production	**I**	3+0+0 = 3
2	Agron502	Principles And Practices Of Soil Fertility and Nutrient Management	**I**	2+0+1 = 3
3	Agron506	Agronomy Of Major Cereals and Pulses.	**I**	2+0+0 = 2
4	Agron511	Cropping System and Sustainable Agriculture	**I**	2+0+0 = 2
5	Agron 503	Principles and Practices Of Weed Management	**II**	2+1+0 = 3
6	Agron 504	Principles and Practices Of Water Management	**II**	2+1+0 = 3
7	Agron 513	Principles and Practices Of Organic Farming	**II**	2+1+0 = 3
8	Agron 512	Dryland Farming and Watershed Management	**II**	2+1+0 = 3
		Total Credit		**22**

PROFESSIONAL ELECTIVE =PEC/ Minor course (Total 08)

Sl.	Code No.	Subject	Semester	Credits
1	Soil 506	Soil Biology and Biochemistry	I	2+0+1 = 3
2	Soil 508	Soil, Water and Air Pollution	I	2+0+1 = 3
3	APP 501	Principles of Plant Physiology	II	2+0+1 = 3
		Total Credit		**9**

SUPPORTING COURSES = PSC (Total 06)

Sl.	Code No.	Subject	Semester	Credits
1	STAT 502	Statistical Methods in Applied Science	I	3+0+1 = 4
2	STAT 511	Experimental Design	II	2+0+1 = 3
		Total Credit		**07**

RESEARCH PROJECT(S) =PRC (Total 30)

Sl.	Code No.	Subject	Semester	Credits
01	Agron 599	Master's Research	**III**	0+0+15 = 15
		Total Credit		**15**

SEMINAR =SC(Total 01)

Sl.	Code No.	Subject	Semester	Credits
01	Agron 591	Master's Seminar	III	**1+0+0 = 1**
02	Agron 599	Master's Research Seminar	IV	0+0+15 = 15
		Total Credit		**16**

ANY OTHER (PL SPECIFY) NON-CREDIT =NC (Total 05)

Sl.	Code No.	Subject	Semester	Credits
01	PGS 501	Library and information services	**I**	0+0+1 = 1
02	PGS 502	Technical writing and communications skills	**I**	0+0+1 = 1
03	PGS-503	Intellectual property and its management in agriculture	**II**	1+0+0 = 1
04	PGS 504	Basic concepts in laboratory techniques	**II**	0+0+1 = 1
05	PGS 505	Agricultural Research, Research Ethics and Rural Development programmes	**III**	1+0+0 = 1
		Total Credit		**05**

Induction Program

Induction program for students to be offered right at the start of the first year It is mandatory. AKS University has design an induction program for 1st year student, details are below:

i Physical activity

ii Creative Arts

iii Universal Human Values

iv Literary

v Proficiency Modules

vi Lectures by Eminent People

vii Visits to local Areas

viii Familiarization to Dept./Branch & Innovations

Mandatory Visits/ Workshop/Expert Lectures:

I. It is mandatory to arrange one industrial visit every semester for the students.

II. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.

III. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from industry.

Evaluation Scheme:

1. For Theory Courses:

I. The Weightage of Internal assessment is 50% and

II. End Semester Exam is 50%

The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

2.- For Practical Courses:

I. The Weightage of Internal assessment is 50% and

II. End Semester Exam is 50%

The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

3. For Summer Internship / Projects / Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Semester wise Course Structure

Semester wise Brief of total Credits and Teaching Hours

Semester	L	T	P	Total Hour	Total Credit
Semester -I	16	00	06	22	22
Semester -II	13	00	07	20	20
Semester -III	02	00	15	17	17
Semester -IV	00	00	15	15	15
Total	**31**	**00**	**43**	**74**	**74**

AKS University

Faculty of Agriculture Science and Technology

Department of Agronomy

2 year / 4 Semester Curriculum Structure

Total Credit (2 year / 4 Semester Course) **74**

Semester wise Structure Curriculum

(L= Lecture, T= Tutorial, P= Practical & H = Hours per week)

SEMESTER-1

S.N.	Category	Code	Course Title	L	T	P	Total H	Credits
MajorCourses								
1	PCC	Agron 501	Modern concept in crop production	3	0	0	3	3(3+0)
2	PCC	Agron 502	Principles and practices of soil Fertility and nutrient management	2	0	1	3	3(2+1)
3	PCC	Agron 506	Agronomy of major cereals and pulses.	2	0	0	2	2(2+0)
4	PCC	Agron 511	Cropping system and sustainable agriculture	2	0	0	2	2(2+0)
			Total				**10**	**10(9+1)**
MinorCourses								
5	PEC	Soil 506	Soil Biology and Biochemistry	2	0	1	3	3(2+1)
	PEC	Soil 508	Soil, Water and Air Pollution	2	0	1	3	3(2+1)
			Total				**6**	**6(4+2)**
Supporting Courses								
6	PSC	STAT502	Statistical methods in applied Science	3	0	1	4	4(3+1)
			Total				**4**	**4(3+1)**
Non-Credit Compulsory Courses								
7	NC	PGS502	TechnicalWriting and communication skill	0	0	1	1	1(0+1)
8	NC	PGS501	Library and in formation services	0	0	1	1	1(0+1)
			Total				**2**	**2(0+2)**
			Grand Total	16	00	06	**22**	**22(16+6)**

AKS University

Faculty of Agriculture Science and Technology

Department of Agronomy

Semester wise Structure Curriculum

(L= Lecture, T= Tutorial, P= Practical & H = Hours per week)

SEMESTER-II

S.N.	Category	Code	Course Title	L	T	P	Total H	Credits
MajorCourses								
1	PCC	Agron 503	Principles and Practices Of Weed Management	2	0	1	3	3(2+1)
2	PCC	Agron 504	Principles and Practices Of Water Management	2	0	1	3	3(2+1)
3	PCC	Agron 513	Principles and Practices Of Organic Farming	2	0	1	3	3(2+1)
4	PCC	Agron 512	Dryland Farming and Watershed Management	2	0	1	3	3(2+1)
			Total	**8**	**0**	**4**	**12**	**12(8+4)**
Minor Courses								
5	PEC	APP 501	Principles of Plant Physiology	2	0	1	3	3(2+1)
			Total	**2**	**0**	**1**	**3**	**3(2+1)**
Supporting Courses								
6	PSC	STAT511	Experimental design	2	0	1	3	3(2+1)
			Total	**2**	**0**	**1**	**3**	**3(2+1)**
Non-Credit Compulsory Courses								
7	NC	PGS503	Intellectual Property and Its management in Agriculture	1	0	0	1	1(1+0)
8	NC	PGS504	Basic Concepts in Laboratory Techniques	0	0	1	1	1(0+1)
			Total	**1**	**0**	**1**	**2**	**2(1+1)**
			Grand Total	13	00	07	**20**	**20(13+7)**

AKS University

Faculty of Agriculture Science and Technology

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Semester wise Structure Curriculum

(L= Lecture, T= Tutorial, P= Practical & H = Hours per week)

SEMESTER-III

S.N.	Category	Code	Course Title	L	T	P	Total H	Credits
Research /Project work / Seminar								
1	PRC	Agron 591	Master's Seminar	0	00	**15**	15	15(0+15)
2	SC	Agron 599	Master's Research Seminar	1	00	00	01	1(1+0)
			Total	1	00	15	**16**	**16(1+15)**
Non-Credit Compulsory Courses								
3	NC	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1	0	0	1	1(1+0)
			Total	**01**			1	**1(1+0)**
			Grand Total	**02**	00	15	**17**	**17 (2+15)**

AKS University

Faculty of Agriculture Science and Technology

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Semester wise Structure Curriculum
(L= Lecture, T= Tutorial, P= Practical & H = Hours per week)
SEMESTER-IV

S.N.	Category	Code	Course Title	L	T	P	Total H	Credits
1	SC	Agron 599	Master's Research Seminar	0	00	15	15	15(0+15)
			Total	**00**	**00**	**15**	**15**	**15(0+15)**
			Grand Total					**74 (31+43)**

AKS University

Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code: **Agron - 501 (3+0)**
Course Title: **Modern Concept in Crop Production**

Pre-requisite: Before start of course classes student required sound knowledge in respect of basic principles of agronomy, precesion farming and natural farming hypothesis for the purpose of increasing crop production to fulfil the supply of food.

Rationale: This course has impact to increase the knowledge of PG students of agronomy by which they will become as master towards adopting modern crop production techniques for enhance the crop productivity with ceo-friendly environment.

Course Outcomes :

Agron 501.1 Impart the modern concepts of crop production including tillage, optimization of plant growth population and planting geometry.
Agro 501.2 Discuss about growth regulators and their role in agriculture with plant nutrition and disease tolerance in field crop.
Agro 501.3 Implementation and recognition of organic farming with the concept of ideal plant types.
Agro 501.4 Describe the impact of latest crop management practices on crop productivity and resource use efficiency.
Agro 501.5 Analyzing the crop growth analysis along with crop modelling in precision farming.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program core (SDGS)	AGRO 501	Modern concept in crop production	3	0	1	1	5	3

Legend: **CI:** Class room Instructions (Includes different instructional strategies i.e. Lecture(L), Tutorial (T)and others),
LI: Laboratory Instruction (Includes Practical performance sin laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure out come of Learning.

Scheme of Assessment:
Theory

Board of Study	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks** (PRA+ ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3)10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	
Program core (SDGS)	AGRO 501	Modern concept in crop production	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Sessional Work (SW), and Self-Learning (SL). Which students are familiar through various mode of instruction .As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agro- 501.1 Students will acquaint familiar with the knowledge of Cropping systems physical resources, soil and water management in cropping systems.

Approximate Hours

Item	Appx Hrs.
CI	05
LI	00
SW	01
SL	01
Total	07

Session Out comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 **SO1.1**To brought knowledge in crop production technology in relation to crop growth & development **SO1.2** To gain knowledge about crop zones of M.P. **SO1.3**To impart subject back ground **SO1.4.** To understand different agro-ecological zones of India		**Unit-1**.Crop growth analysis in relation to environment agro-ecological zones of India **1.1.** Give introductory remark in crop production **1.2** Introduce students about crop growth **1.3** To obtain best efforts in relation to precision farming **1.4** To explain in details information about A.E. Zones **1.5** Factor affecting crop growth & development	To Gain knowledge about N-yield inverse law The assessment of crop growth analysis Prepare a map of crop zone of M.P.

SW-1 Suggested Sessional Work (SW):
Assignments: Enlist in detail- Agro- ecological zones of India, Agro climatic zones.

a. Other Activities(Specify): Field activities

Agron501.2 students will able to acquaints knowledge about Concept of sustainability agriculture and modern crop production technology.

Approximate Hours

Item	AppxHrs.
CI	05
LI	00
SW	03
SL	02
Total	10

Session Out comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Student know very well about biological plough. **SO1.2** knowledge gain about baul unit **SO1.3** Understand the law of diminishing return **SO1.4.**Express the inverse yield N Law & its applicability **SO1.5**. Deals mischerlich law to understand the phosphorus availability.		**Unit-2** Quantitative agro biological principles and inverse yield nitrogen law mischerlich yield equation. Its interpretation and applicability, Baule unit. **1.1** To teach the details of modern crop production technology **1.2** Introduction of biological plough crops & its practices. **1.3** Study of inverse yield N law. **1.4** Details instruction about use of Baul unit.	1. How to prove the law of diminishing return 2.Prepare a report with suitable figure. 3. Details study of biological plough

		1.5 Introductory information of Mischerlich equation	

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare a suitable figure to indicate the biological plough technique

b. Other Activities (Specify): Research on most suitable modern crop production technology

Agron501.3 students will able to identify the interactions and interpretation under different scientific method.

Approximate Hours

Item	AppxHrs.
CI	05
LI	00
SW	01
SL	01
Total	07

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Student will become to gain knowledge about lodging in cereals and its facts. **SO1.2** Knowledge about physiology of grain yield in cereals. **SO1.3** Students acquired knowledge in relation to plant population and geometry **SO1.4**.Express the concept of ideal plant type **SO1.5** Deals difference between crop modeling and ideal plant type for desired crop yield		**Unit-3** 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. Objectives: To teach the details of lodging, plant geometry and concept of plant types for higher yield. **1.1** Introduction of lodging **1.2** Study of crop physiology terms. **1.3** Study of difference between plant population and plant geometry **1.4** Crop modeling for enhance crop productivity. **1.5** Details instruction about resource generation by natural farming	1. To prepare lodging strategies 2. Prepare a chart for modern crop production technology. 3. To find out the best level of study individually

SW-1 Suggested Sessional Work(SW):

Assignments: To prepare a chart for modern crop production technology with principles and practices for the purpose of sustainable yield

c. Other Activities(Specify): New research work assigned for students to develop innovation

Agron501.4 students will able to acquaints knowledge for crop production technology, measure for control of crop lodging

Approximate Hours

Item	Appx Hrs.
CI	05
LI	00
SW	01
SL	01
Total	07

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Students will become to know Scientific principles of crop production **SO1.2** Student acquired knowledge about crop response function **SO1.3** Understand the concept of soil plant relations **SO1.4**.Express knowledge about use of growth hormones and regulators **SO1.5** Student acquainted knowledge in relation to yield and environmental stress and concept of soil plant relations		**Unit-4** 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. **1.1** To Teach the Scientific principles of crop production **1.2** To study of concept of soil plant relations **1.3** Introductory information brought to amongst the students use of growth hormones **1.4** Detail information acquired to students for better adoption of growth regulators. **1.5** Detail knowledge in relation to yield and environmental stress	1. Student advice to detail study soil plant water relationship 2. Prepare report on crop response production function 3. Student directed to make a chart for Scientific principles of crop production

SW-1 Suggested Sessional Work(SW):

Assignments: What is crop production technology, definition of agronomy and its importance, detail information about production functions?

d. Other Activities (Specify): Detail study of soil plant water relationship

Agro501.5PG students will become expert in crop production technology and use of plant growth regulators and their role in crop production.

Approximate Hours

Item	Appx Hrs.
CI	05
LI	00
SW	01
SL	01
Total	07

Session outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Knowledge brought to the students in respect of integrated farming system **SO1.2** Students will become to know very well about organic farming, and resource conservation technology **SO1.3** Student know the constraints of dry farming and WHT **SO1.4**. They understand as a familiar precision agriculture e.g. GIS, GPS and remote sensing **SO1.5.** Students will become to know protected agriculture		**Unit-5-** Integrated farming systems, 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 integrated nutrient management; precision agriculture. Modem crop production concepts: soil less cultivation, Aeroponic, Hydroponic, Robotic and terrace farming. use of GIS, GPS and remote sensing in modem agriculture, precision farming and protected agriculture. **1.1** Introduce about integrated farming system. **1.2** Study in details tillage and nutrient need of corp. **1.3** Detail instruction about different cultivation technique **1.4** Introductory information in regard to remote sensing and use of drown technology **1.5** Detail in protected agriculture	2. Prepare a list Integrated farming systems 3. Detail study of WHT. 4. To get and prepare a project about concept of balance nutrition

SW-1 Suggested Sessional Work(SW):

Assignments: Integrated farming systems as a project report, organic farming technology including modern concept of tillage

e. Other Activities (Specify): Use of remote sensing, drown technology besides knowledge gain in regards of GIS and GPS etc.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+LI+SW+Sl)
Agro 501 Impart the modern concepts of crop production including tillage, optimization of plant growth population and planting geometry	05	00	01	01	07
Agro 501.2 Discuss about growth regulators and their role in agriculture with plant nutrition and disease tolerance in field crop.	05	00	03	02	10
Agro 501.3 Implementation and recognition of organic farming with the concept of ideal plant types	05	00	01	01	07
Agro 501.4 Describe the impact of latest crop managemer practices on crop productivity and resource use efficiency.	05	00	01	01	07
Agro 501.5 Analyzing the crop growth analysis along with crop modelling in precision farming.	05	00	01	01	07
Total Hours	25	00	07	06	38

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Crop growth analysis in relation to environment agro- ecological zones of India	07	02	02	11
CO-2	Quantitative agro biological principles and inverse yield nitrogen law mischerlich yield equation. Its interpretation and applicability, Baule unit.	05	02	02	09
CO-3	Effect of lodging in cereals; physiology of grain yield in cereals; concept of ideal plant type and crop modelling for desired crop yield.	07	02	02	11

CO-4	Scientific principles of crop production yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition.	05	02	02	9
CO-5	Integrated farming systems, modern concept of tillage use of GIS, GPS and remote sensing in modem agriculture, precision farming and protected agriculture.	07	02	01	10
Total		31	10	09	50

Legend: R:Remember,U:Understand,A:Apply

The end of semester assessment for Modern Concept in Crop Production will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above asks. Teachers can also design different task sapper requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visitto cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming.

Suggested Learning Resources:

(a)Books*:*

S. No.	Title	Author	Publisher	Edition &Year
1	Principles and practices of agronnomy.	Balasubramaniyan p & palaniappan sp.	Agronbios	2001.
2	Reddy sr	Principles of crop production.	Kalyani publ	2000
3	Principles and practices of agronnomy	Singh ss	Kalyani publ	2006.

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Cos, POs and PSOs Mapping
Course Code:-Agron- 501
Course Title: - Modern concept in crop Production

Course Outcomes	**Program Outcomes**									**Program Specific Outcome**				
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				to decision in various part of agriculture	.									
CO1-Impart the modern concepts of crop production including tillage, optimization of plant growth population and planting geometry.	3	2	3	1	3	3	1	1	3	3	1	2	3	1
CO2 Discuss about growth regulators and their role in agriculture with plant nutrition and disease tolerance in field crop.	3	3	3	1	3	3	1	1	3	3	1	3	2	1

CO3 Implementation and recognition of organic farming with the concept of ideal plant types.	3	2	1	3	2	3	1	1	3	3	2	2	1	2
CO 4 Describe the impact of latest crop management practices on crop productivity and resource use efficiency.	3	2	1	3	1	3	1	1	1	3	1	3	2	1
CO5 Analyzing the crop growth analysis along with crop modelling in precision farming.	3	1	2	3	1	3	1	1	1	2	3	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Modern concept in crop Production

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO1-Impart the modern concepts of crop production including tillage, optimization of plant growth population and planting geometry.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit-1**.Crop growth analysis in relation to environment agro- ecological zones of India 1.1, 1.2,1.3,1.4,1.5.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO2 Discuss about growth regulators and their role in agriculture with plant nutrition and disease tolerance in field crop.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-2** Quantitative agro biological principles and inverse yield nitrogen law mischerlich yield equation. Its interpretation and applicability, Baule unit 1.1, 1.2,1.3,1.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO3 Implementation and recognition of organic farming with the concept of ideal plant types.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-3** 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. 1.1, 1.2,1.3,1.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO 4 Describe the impact of latest crop management practices on crop productivity and resource use efficiency.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 4** 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. 1.1, 1.2,1.3,1.4 1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12	CO5 Analyzing the crop growth analysis along with crop	**SO1.1** **SO1.2**		**Unit 5** Integrated farming systems, organic farming, and resource conservation	As mentioned in page number ……..

PSO 1,2, 3, 4, 5	modelling in precision farming.	**SO1.3** **SO1.4** **SO1.5**		technology including modern concept of tillage dry farming determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture. Modem crop production concepts: soil less cultivation, Aeroponic, Hydroponic, Robotic and terrace farming. use of GIS, GPS and remote sensing in modem agriculture, precision farming and protected agriculture. 1.1, 1.2,1.3,1.4 1.5	

AKS University
Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc.(Ag)Agronomy Program

Course Code:	**Agron -501**
CourseTitle:	**Principles And Practices Of Soil Fertility and Nutrient Management**
Pre-requisite:	Student should have basic knowledge of soil fertility and nutrient management, Principles, and concept of sustainable agriculture. Organic farming system and Nutrient use efficiency and fertility status in the soil.
Rationale:	The students should be acquainted with the knowledge of soil fertility and nutrient management. They are involved in sustainable agriculture as they to maintain soil fertility and physical condition too and to prevent pests and diseases further the also maintain the ecological balance, and ensure efficient use of resources such as water and nutrients. This field of study and practice is driven by several key factors and considerations: Safety ,Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

Agron501.1 To impart knowledge of fertilizer and nutrient and nutrients status of PGstudents.

Agron501.2 To acquaint skillness towards application of organic manures for pushing up the production in natural farming

Agron501.3 Student of PG will able to acquire knowledge in increasing nutrients use efficiency by observing economical aspects. To get knowledge on sustainable agricultural practices such as organic farming.

Agron501.4 To judge the fertility status in the soil by students.

Agron501.5 To categorize the fertilizers in different groups as per availability of nutrients elements e.g. single, double and multiple nutrients container.

SchemeofStudies:

Board ofStudy	Course Code	CourseTitle	Schemeofstudies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	Total StudyHours(CI+LI+SW+SL)	
Program Core (SDGs)	AGRO-501	Principles and PracticesofSoil Fertility and Nutrient Management	3	1	1	1	6	3

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop,fieldorotherlocationsusing different instructional strategies)
SW: SessionalWork(includesassignment,seminar,miniprojectetc.),
SL: SelfLearning,
C: Credits.

Note: SW&SLhastobeplannedandperformedunderthecontinuousguidanceandfeedbackof teachertoensureoutcome of Learning.

SchemeofAssessment:

Theory

Boardof Study	CouseCode	CourseTitle	SchemeofAssessment(Marks)							
			ProgressiveAssessment(PRA)						End Semester Assessment	Total Marks
			Class/ Home Assignment 5number3 marks each(CA)	ClassTest2 (2 bestout Of3) 10markseach (CT)	Seminarone (SA)	ClasActivity anyone (CAT)	Class Attendance (AT)	TotalMarks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA + ESA)
Program Core (SDGs)	Agro-501	Principles and Practices of Soil Fertility and Nutrient Management	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are Anticipated to accomplish through various modes of instruction including Classroom Instruction (CI),

Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agron 501.1 To impart knowledge of fertilizer and nutrient and nutrients status of PG students.

ApproximateHours

Item	Appx Hrs.
Cl	4
LI	4
SW	1
SL	2
Total	11

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the soil fertility and productivity. **SO1.2**Understand the Soil Fertility and management system. **SO1.3**Understandthe Relationship between nutrient supply and crop growth. **SO1.4**Understand the organic farming.	1. Determination of soil pH and soil EC 2. Determination of soil organic C	**Unit-1. 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.** **1.1** Introduction to soil fertility and productivity and its factors affecting. **1.2** Indices and its features of good soil management. **1.3** Introduction relationship between nutrient supply and crop growth. Like nutrient pply all major and micro nutrients. **1.4** Explain the organic farming and its definition and concept.	1. Soil fertility and productivity - factors affecting features of goodsoil management. 2. Organic farming- basic concepts and definitions.

SW-1SuggestedSessionalWork(SW):
Assignments

What is Soil fertility and productivity? definition, in dices and its importance and its management in soil fertility and nutrient status.

a. OtherActivities(Specify):

Research on study soil analysis of physical chemical and biological properties for the Satna Region.

Agron511.2 To acquaint skillness towards application of organic manures for pushing up the production in natural farming.

ApproximateHours

Item	AppxHrs.
Cl	6
LI	2
SW	1
SL	1
Total	12

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Criteria of essential nutrients and its their functions. **SO1.2** Understand the classification and nutrient deficiency symptoms under major and micro nutrients. **SO1.3** Understand the Transformation and dynamics of major plant nutrients in the soil Like Carbon, hydrogen and oxygen are mainly obtained from water and air. **SO1.4**.Understandthe Transformation like Nitrogen, Phosphorus, Potassium etc. **SO1.5**Understandthesoiland water management	Determination of available in, p, k and s of soil	**Unit-2 Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.** **1.1** Introduction to Concept and Criteria of essential nutrients sustainability in Soil Fertility and Nutrient Management. **1.2** Scope and Objectives of Soil Fertility and Nutrient Management **1.3**. production potential under Transformation and dynamics of major plant nutrients in the soil. **1.4** Production potential under Transformation like Nitrogen, Phosphorus, Potassium **1.5** Introduction to soil fertility and productivity and its advantages. **1.6** Mechanism of yield advantage in management of soil fertility and productivity.	1.Conceptof Sustainability in soil fertility and nutrient management systems and farming systems.

SW-1SuggestedSessionalWork(SW):

Assignments:

Concept in Criteria of essential nutrients systems and farming systems, scope and Objectives production potential under Principles and Practices of Soil Fertility and Nutrient Management.

OtherActivities(Specify):

Research on study soil analysis of physical chemical and biological properties for the Satna Region.

Agron501.3 Student of PG will able to acquire knowledge in increasing nutrients use efficiency by observing economical aspects. To get knowledge on sustainable agricultural practices such as organic farming.

ApproximateHours

Item	AppxHrs.
Cl	6
LI	2
SW	1
SL	1
Total	10

SessionOutcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	Self-Learning (SL)
SO1.1 Understand the Crop Diversification for sustainability **SO1.2** Understand the organic farming and role of organic farming to maintain soil Fertility **SO1.3**Understandthecropresidue management; fertilizer use efficiency. **SO1.4.** Understand the organic concentrates their composition, availability, and cropresponses. **SO1.5**Understandtherecyclingof organic wastes and residue management.	Determination of soil organic carbon	**Unit-3 Preparation and use of farmyard manure, compost, green manures, vermicompost, iofertilizers and other organic oncentrates their composition, vailability and cropresponses; ecycling of organic wastes and esidue management. Soil less ultivation.** **1.1** IntroductiontoCrop diversification. **1.2** Introduction to organic Farming and its effects on crop and soil. **1.3** Introduction to organic Farming and its role in sustainable agriculture and to maintain soil Fertility **1.4** Role of organic concentrates their composition, availability and crop responses. **1.5** Role of non-monetary Inputs and low cost technologies. 1.6 New research need on Sustainable agriculture and new innovation on sustainable agriculture.	1.Study on allelopathic effect on crop and new research on sustainable agriculture.

SW-1SuggestedSessionalWork(SW):

Assignments:

Role of non-monetary Inputs and low cost technologies; research need on sustainable agriculture

b. OtherActivities(Specify):

NewResearchonsustainable agriculture

Agron501.4 To judge the fertility status in the soil by students.

ApproximateHours

Item	AppxHrs.
Cl	5
LI	2
SW	1
SL	1
Total	9

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand Commercial fertilizers; composition, relative fertilizer value and cost. SO1.2Understand the different nutrients, residual effects and Fertilizer use efficiency. **SO1.3**Understandthecropresidue management; fertilizer use efficiency. **SO1.4**. Understand the fertilizer Use in intensive cropping system. **SO1.5**Understandtheadvanced Nutritional tools for big data analysis and interpretation.	Determination of total n, p, k and s of soil Determination of total n,p,k, s in plant	**Unit-4** 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**.** **1.1** IntroductiontoCommercial fertilizers. `**1.2** diversification of crop and its importance for sustainability**.** **1.3** Introduction to organic farming and its role in Sustainable agriculture and to maintain soil Fertility **1.4** Introduction to management of crop residue and nutrient use efficiency. **1.5** The fertilizer methods of increasing fertilizer use Efficiency ;nutrient interactions.	1.Study on crop diversification and Importance of organic farming for the sustainable agriculture.

SW-1SuggestedSessionalWork(SW):

Assignments:

Crop diversificati on for sustainability ;role of organic matter in the maintenance of soil Fertility; crop residue management; fertilizer use efficiency

c. OtherActivities(Specify):

Research on nutrient use efficiency.

Agron501.5 To categorize the fertilizers in different groups as per availability of nutrientselementse.g. single, double and multiple nutrients containers.

ApproximateHours

Item	AppxHrs.
Cl	4
LI	2
SW	1
SL	1
Total	8

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Time and methods of manures and fertilizers **SO1.**2UnderstandthePlantfoliar application and its concept **SO1.3**Understandtheorganicand inorganic nutrients **SO1.4**.Understand the plant growth, use of vermicompost and residue wastes in crops.	Computation of optimum and economic yield	**Unit-5 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 vermicompost and residue wastes in crops**. **1.1**Time and methods of manures and fertilizers **1.2** Introduction to Plant foliar application and its concept. **1.3** Introduction to organic and In organic nutrients **1.4**Introduction to the plant growth regulator and their Role in sustainability	1.Study on plant Time and methods of manures and fertilizers

SW-1SuggestedSessionalWork(SW):

Assignments: Understand the Time and methods of manures and fertilizers and their role in sustainability

d. OtherActivities(Specify):

Study on Time and methods of manures and fertilizers and their role in sustainability.

Brief of Hours suggestedf or the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Totalhour (Cl+LI+SW+Sl)
Agron501.1 To impart knowledge of fertilizer and nutrient and nutrients status of PGstudents. .	4	**4**	1	2	11
Agron501.2 To acquaint skillness towards application of organic manures for pushing up the production in natural farming	6	**2**	1	1	10
Agron501.3 Student of PG will able to acquire knowledge in increasing nutrients use efficiency by observing economical aspects. To get knowledge on sustainable agricultural practices such as organic farming.	6	2	1	1	10
Agron501.4 To judge the fertility status in the soil by students.	5	2	1	1	9
Agron501.5 To categorize the fertilizers in different groups as per availability of nutrients elements e.g. single, double and multiple nutrients container	4	**2**	1	1	8
TotalHours	25	**12**	5	6	48

SuggestionforEndSemesterAssessment

CO	UnitTitles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Unit-1. 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.	03	01	01	05
CO-2	Unit-2Criteria of essentiality ofnutrients; Essential plant nutrients their functions, nutrient deficiency symptoms;Transformation and dynamics of major plant nutrients.	02	06	02	10
CO-3	Unit-3 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.	03	07	05	15
CO-4	Unit-4 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.	-	10	05	15
CO-5	Unit-5 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 vermicompost and residue wastes in crops.	03	02	-	05
Total		11	26	13	50

Legend: R:Remember, U:Understand, A:Apply

TheendofsemesterassessmentforPrinciplesandpracticesofsoilfertilityandnutrients management will be held with written examination of 50 marks

Note .DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabovetasks.
Teachers can also design different tasks as per requirement, for end semester assessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Visittofield
7. Demonstration
8. ICTBasedTeachingLearning(VideoDemonstration/TutorialsCBT, Blog,Facebook,Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested LearningResources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	*The nature and propertiesofsoils*	bradyncandweil rr	13thed.Pearson edu.	2002
2	*Growthandmineral nutrition of field crops.*	fageriank, baligarvcand jones ca	Marceldekker.	1991
3	*Soilfertilityand fertilizers.* 7th	havlinjl, beatonjd, tisdalesland nelson wl.	-	2006
4	*Soil fertility managementfor sustainable agriculture*	prasadrand power jf	CrcPr ess.	1997
5	*Manuresand fertilizers*	yawalkarks, agrawaljpandbokd e s	Agri-hortipubl.	2000

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Cos, POs and PSOs Mapping
Course Code:-Agron- 501
Course Title: -Principles and Practices of Soil Fertility and Nutrient

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part of agriculture	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

CO1- To impart knowledge of fertilizer and nutrient and nutrients status of PGstudents	1	3	3	1	2	1	3	3	3	3	1	2	3	1
CO2 To acquaint skillness towards application of organic manures for pushing up the production in natural farming	3	1	3	3	1	2	1	3	3	1	1	3	2	1
CO3 Student of PG will able to acquire knowledge in increasing nutrients use efficiency by observing economical aspects. To get knowledge on sustainable agricultural practices such as organic farming.	1	3	3	1	2	1	3	3	1	3	2	2	1	2

CO 4 To judge the fertility status in the soil by students.	3	2	1	3	1	3	1	3	3	1	2	1	3	1	
CO5 To categorize the fertilizers in different groups as per availability of nutrients elements e.g. single, double and multiple nutrients container	3	1	2	1	3	3	1	1	2	1	3	1	3	1	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:Principles and Practices of Soil Fertility and Nutrient

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO1- To impart knowledge of fertilizer and nutrient and nutrients status of PGstudents	**SO1.1 SO1.2 SO1.3 SO1.4**		**Unit-1**.Soil fertility and productivity - factors affecting; featuresofgoodsoilmanagement;problemsofsupplyand availability of nutrients; relation between nutrient supply andcropgrowth;organicfarming–basicconceptsand definitions. 1.1, 1.2,1.3,1.4	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO2 To acquaint skillness towards application of organic manures for pushing up the production in natural farming	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5**		**Unit-2** Criteria of essentiality ofnutrients;Essential plant nutrients–theirfunctions,nutrientdeficiencysymptoms; Transformationanddynamicsofmajorplantnutrients. 1.1, 1.2,1.3,.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO3 Student of PG will able to acquire knowledge in increasing nutrients use efficiency by observing economical aspects. To get knowledge on sustainable agricultural practices such as organic farming.	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5**		**Unit-3**Preparation and use of farmyard manure, compost, green manures, vermicompost, Biofertilizers and other organic concentrates their composition, availabilityandcropresponses;recyclingof organic wastes and residue management. Soil less cultivation. 1.1, 1.2,1.3,1.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO 4 To judge the fertility status in the soil by students.	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5SO1**		**Unit 4**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 andgrades;methodsofincreasingfertilizeruseefficiency; nutrient interactions. 1.1, 1.2,1.3,1.4 1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12	CO5 To categorize the fertilizers in different groups as	**SO1.1 SO1.2 SO1.3**		**Unit 5** Time and methods of manures and fertilizers application; foliar application and its concept; relative	As mentioned in page number ……..

PSO 1,2, 3, 4, 5	per availability of nutrients elements e.g. single, double and multiple nutrients container	**SO1.4 SO**		performanceoforganicandinorganicnutrients;economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops. 1.1, 1.2,1.3,1.4	

AKS University

Faculty of Agriculture Science and Technology

Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code: **Agron 506**

Course Title: **Agronomy of major cereals, pulses (2+0)**

Pre-requisite: Student should have specific knowledge of crops, cultivation practices and their management.

Rationale: The students should be acquainted with the knowledge of Crops and patterns refer to the types and sequences of crops that are grown. They are involve in sustainable agriculture as they to maintain soil fertility and physical condition too and to prevent pests and diseases further the also maintain the ecological balance, and ensure efficient use of resources such as water and nutrients. This field of study and practice is driven by several key factors and considerations: Safety, Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

Agron 506.1 pg students of agronomy will become expert and determine crop husbandry of cereals and pulses crops.

Agron 506.2 pg students acquire knowledge towards nutrition of crops and its quality to develop architectural characteristics.

Agron 506.3 student may become expert in processing technology of cereals and pulses to increase value.

Agron 506.4 students will able to become expert for resolving the problems of soil, water and nutrient status.

Agron 506.5 students may acquaint to examine the different new varieties of cereals and pulses

Scheme of Studies:

Category of course	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI +LI+SW+SL)	
Program Core (PCCs)	Agron 506	Agronomy of major cereals, pulses	2	0	1	1	4	2

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensure the outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
Program Core (PCC)	Agronn 506	Agronomy of major cereals and pulses.	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should

showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agron 506.1 pg students of agronomy will become expert and determine crop husbandry of cereals and pulses crops

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	1
SL	1
Total	08

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 pg students of agronomy will become expert **SO1.2** Determine crop husbandry of cereals and pulses crops. .		**Unit 1** 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 wheat, barley, oat. **1.1** origin and history, area and production, classification,	1. origin and history, area and production, classification,. 2. improved varieties, adaptability, climate, soil, water

		1.2 improved varieties, adaptability, **1.3** climate, soil, water **1.4** cultural requirements, **1.5** nutrition, quality components, **1.6** handling and processing of the produce for maximum production of wheat, barley, oat.	

SW-1 Suggested Sessional Work (SW):

Assignments:

What is Cropping systems? definition, indices and its importance and physical resources and its management in cropping system.

a. **Other Activities (Specify):**

Agron 506.2 pg students acquire knowledge towards nutrition of crops and its quality to develop architectural characteristics.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	2
SL	1
Total	09

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 pg students acquire knowledge towards nutrition of crops **SO1.2** Its quality to develop architectural characteristics.		**Unit 2** 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 rice, maize, sorghum, pearlmillet, fingermillet. **1.1** Origin and history, area and production, classification, **1.2** improved varieties, adaptability, **1.3** climate, soil, water **1.4** culturalrequirements, **1.5** nutrition quality components, **1.6** handling and processing of the produce for maximum production of rice, maize, sorghum, pearlmillet, fingermillet.	1. Origin and history, area and production, classification of rice. 2improved varieties, adaptability, climate of maize.

SW-1 Suggested Sessional Work (SW):

Assignments:

What is Cropping systems? definition, indices and its importance and physical resources and its management in cropping system.

b. Other Activities (Specify):

Research on most suitable Cropping systems for the Satna Region.

SW-1 Suggested Sessional Work (SW):

Assignments:

Concept of sustainability in cropping systems and farming systems, scope and Objectives production potential under different cropping system.

c. Other Activities (Specify):

Research on most suitable intercropping for the Satna Region.

Agron 506.3 student may become expert in processing technology of cereals and pulses to increase value.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Student may become expert in processing technology of cereals and pulses to increase value. **SO1.2** Student may become expert in processing technology of pulses to increase		**Unit 3** Origin and history, areaand production, classification, improvedvarieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of pea, chickpea, lentil **1.1** Origin and history, area and production, **1.2** classification, improved varieties, adaptability, **1.3** climate, soil, water **1.4** cultural requirements, **1.5** nutrition, quality components, **1.6** handling and processing of the produce for maximum production of pea, chickpea, lentil	**1.** climate, soil, water and cultural requirements of chickpea **2.** handling and processing of the produce for maximum production of pea

SW-1 Suggested Sessional Work (SW):

Assignments:

Role of non-monetary Inputs and low-cost technologies; research need on sustainable agriculture

d. OtherActivities(Specify):

New Research on sustainable agriculture.

Agron 506.4 Students will able to become expert for resolving the problems of soil, water and nutrient status.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes(SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction(CI)**	**Self-Learning (SL)**
SO1.1 students will able to become expert for resolving the problems of soil, water **SO1.2** Students will able to become expert for resolving the problems of nutrient status.		**Unit 4** Origin and history, areaand production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of green gram, black gram, pigeon pea. **4.1** Origin and history, area and production, **4.2** classification, improved varieties, adaptability, **4.3** climate, soil, water **4.4** cultural requirements, **4.5** nutrition and quality components, **4.6** handling and processing of the produce for maximum production of green gram, black gram, pigeon pea	1. cultural requirements, nutrition and quality components of pigeon pea. 2.Handling and processing of the produce for maximum production of green gram, black gram,

SW-1 Suggested Sessional Work (SW):

Assignments:

Crop diversification for sustainability; role of organic matter in maintenance of soil Fertility; crop residue management;fertilizer use efficiency

e. Other Activities(Specify):

Research on nutrient use efficiency

Agron 506.5 Students may acquaint to examine the different new varieties of cereals and pulses.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 students will able to become expert for resolving the problems of soil, water **SO1.2** Students will able to become expert for resolving the problems of nutrient status.		**Unit 4** 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 green gram, black gram, pigeon pea. **1.1** Origin and history, area and production, **1.2** classification, improved varieties, adaptability, **1.3** climate, soil, water **1.4** cultural requirements, **1.5** nutrition and quality components, **1.6** handling and processing of the produce for maximum	1. cultural requirements, nutrition and quality components of pigeon pea. 2.Handling and processing of the produce for maximum production of green gram, black gram,

		production of green gram, black gram, pigeon pea.	

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory (LI)	Sessionl work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
Agron 506.1 pg students of agronomy will become expert and determine crop husbandry of cereals andpulses crops.	5	0	1	1	08
Agron 506.2 pg students acquire knowledge towardsnutrition of crops and its quality to develop architectural characteristics.	6	0	2	1	09
Agron 506.3 student may become expert in processing technology of cereals and pulses toincrease value.	6	0	1	1	8
Agron 506.4 students will able to become expert forresolving the problems of soil, water and nutrient status.	6	0	1	1	8
Agron 506.5 students may acquaint to examine thedifferent new varieties of cereals and pulses.	6	0	1	1	8
Total Hours	29	0	7	6	41

Suggestion for End Semester Assessment

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Unit 1** 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 wheat, barley, oat.	08	03	02	13
CO-2	**Unit 2** 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 rice, maize, sorghum, pearlmillet, fingermillet.	08	04	02	12
CO-3	**Unit 3** 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 pea, chickpea, lentil .	07	03	02	12
CO-4	**Unit 4** 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 green gram, black gram, pigeon pea.	08	02	03	13
Total		29	12	09	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Introduction to principles and practices of organic farming will beheld with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for abovetasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Visit to farm/ field
6. Demonstration

Suggested Learning Resourcese

(a) *Books :*

S. No.	Title	Author	Publisher	Edition & Year
1	*Science of field crop production*.	hunsigi g and krishna kr.	Oxford & ibh.	1998.
2	.*Advances in pulse production technology*.	jeswani lm and baldev b	icar	1997
3	*Seed technology*.	khare d and bhale ms.	Scientific publ	2000
4	*Maize production in india:*	kumar ranjeet and singh np	*golden grain in transition*	2003

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Cos, POs, and PSOs Mapping
Course Code:-Agron-506
Course Title: - Agronomy Of Major Cereals, Pulses

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				part of agriculture										
CO1- pg students of agronomy will become expert and determine crop husbandry of cereals and pulses crops.	3	3	3	1	1	3	3	1	3	2	1	1	3	3
CO2 pg students acquire knowledge towards nutrition of crops and its quality to develop architectural characteristics.	3	3	3	3	1	3	2	1	1	3	1	3	3	1
CO3 student may become expert in	3	2	3	1	3	1	3	3	2	1	1	2	3	2

processing technology of cereals and pulses to increase value.														
CO 4 students will able to become expert for resolving the problems of soil, water and nutrient status.	3	2	1	1	3	3	2	1	1	3	1	3	2	3
CO5 students may acquaint to examine the different new varieties of cereals and pulses.	3	2	1	1	3	1	3	1	3	2	3	3	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Agronomy Of Major Cereals, Pulses

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1**- pg students of agronomy will become expert and determine crop husbandry of cereals and pulses crops.	**SO1.1 SO1.2**		**Unit 1** 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 wheat, barley, oat. 1.1,1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO2** pg students acquire knowledge towards nutrition of crops and its quality to develop architectural characteristics.	**SO1.1 SO1.2**		**Unit 2** 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 rice, maize, sorghum, pearlmillet, fingermillet. 1.1,1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO3** student may become expert in processing technology of cereals and pulses to increase value.	**SO1.1 SO1.2**		**Unit 3** 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 pea, chickpea, lentil 1.1,1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..

PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO 4** students will able to become expert for resolving the problems of soil, water and nutrient status.	**SO1.1** **SO1.2**		**Unit 4** 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 green gram, black gram, pigeon pea. 1.1,1.2,1.3,1.4,1.5,1.6.	As mentioned in page number …….
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5** students may acquaint to examine the different new varieties of cereals and pulses.	**SO1.1** **SO1.2**		**Unit 5** 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 green gram, black gram, pigeon pea. 1.1,1.2,1.3,1.4,1.5,1.6.	As mentioned in page number …….

AKS University

Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code: **Agron- 511 (2+0)**

Course Title: **Cropping systems and sustainable agriculture**

Pre-requisite: Student should have basic knowledge of cropping system, concept of sustainable agriculture. Farming system and its types and Nutrient use efficiency and Ideotype concept.

Rationale: The students should be acquainted with the knowledge of Cropping systems and patterns refer to the types and sequences of crops that are grown. They are involve in sustainable agriculture as they to maintain soil fertility and physical condition too and to prevent pests and diseases further the also maintain the ecological balance, and ensure efficient use of resources such as water and nutrients**.** This field of study and practice is driven by several key factors and considerations: Safety, Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

Agron 511.1 Students acquaint will familiar with the knowledge of Cropping systems physical resources, soil and water management in cropping systems.

Agron 511.2 students will able to acquaints knowledge about Concept of sustainability in cropping systems and farming systems and types of cropping system and its advantages.

Agron 511.3 Students will able to identify the interactions and allelopathic effects; competition relations and become become expert in calculate the monetary returns

Agron 511.4 Students will able to acquaint knowledge to Crop diversification, role of organic matter in maintenance of soil Fertility, crop residue management and nutrient use efficiency.

Agron 511.5PG students will become expert in Plant ideotypes for drylands plant growth regulators and their role in sustainability.

Scheme of Studies:

Category of Course	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW +SL)	

		Cropping systems and sustainable agriculture	02	0	1	1	04	2

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture(L) and Tutorial (T) and others),
LI : Laboratory Instruction(Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
Program Core (SDGs)	Agron-511	Cropping systems and sustainable agriculture	10	40				50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agron511.1 Students acquaint will familiar with the knowledge of Cropping systems physical resources, soil and water management in cropping systems.

Approximate Hours

Item	Appx Hrs.
Cl	05
LI	0
SW	1
SL	1
Total	07

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Cropping systems. **SO1.2** Understand the cropping system and farming system. physical resources. **SO1.3** Understand the physical resources like soil, water etc. **SO1.4** Understand the soil and water management in cropping system. .		**Unit-1.Cropping systems: definition, indices and its importance; physical resources, soil And water management in cropping systems; assessment of land use.** **1.1**Introduction to cropping system and its benefit. **1.**Indices and its importance calculate the different indices **1.3**Introduction to physical resources, soil and water. **1.4**Explain the soil And water management intercropping systems **1.5** introduction to assessment of land use.	1. Cropping system and know the importance of cropping system and management of resources. 2. The assessment of land use according to the crop

SW-1 Suggested Sessional Work(SW):
Assignments:

What is Cropping systems? definition, indices and its importance and physical resources and its management in cropping system.

a. Other Activities (Specify):
Research on most suitable Cropping systems for the Satna Region.

Agron511.2 students will able to acquaints knowledge about Concept of sustainability in cropping systems and farming systems and types of cropping system and its advantages.

Approximate Hours

Item	Appx Hrs.
Cl	08
LI	0
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Concept of sustainability in cropping systems and farming systems. **SO1.2**Understand the scope and Objectives cropping systems and farming systems **SO1.3** Understand the production potential under monoculture cropping, multiple cropping potential under monoculture cropping, multiple cropping **SO1.4**.Understand the Alley cropping, sequential cropping and intercropping **SO1.5** Understand the soil and water management in cropping system .		**Unit-2Concept 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.** **1.1**Introduction to Concept of sustainability in cropping systems and farming systems **1.2**Scope and Objectives of cropping systems and farming systems **1.3**.production potential under monoculture cropping, multiple cropping **1.4**production potential under multiple cropping. **1.5**production potential under Alley cropping **1.6**production potential under sequential cropping **1.7** Introduction to intercropping and its advantages. **1.8** Mechanism of yield advantage in intercropping systems.	1.Concept of sustainability intercropping systems and farming systems in satna region. 2.Intercropping and its advantage and farmers are benefited from intercropping.

SW-1 Suggested Sessional Work(SW):

Assignments:

Concept of sustainability in cropping systems and farming systems, scope and Objectives production potential under different cropping system.

b. Other Activities (Specify):

Research on most suitable intercropping for the Satna Region.

Agron511.3 Students will able to identify the interactions and allelopathic effects; competition relations and become become expert in calculate the monetary return.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Above and below ground interactions **SO1.2**Understand the allelopathic effects of weed on crop, weed on crop and crop on weed **SO1.3** Understand the competition relations between plants and Multi-storied cropping and yield stability in intercropping **SO1.4**.Understand the role of non-monetary Inputs and low cost technologies **SO1.5**Understand the research need on sustainable agriculture**.**		**Unit-3 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.** **1.1**Introduction to above and below ground interactions. **1.2** Introduction to allelopathic and its effects on crop . **1.3**.Introduction to competitive relationship between crops**.** **1.4**.Multi-storied cropping and yield stability in intercropping **1.5**Role of non-monetary Inputs and low cost technologies. **1.6** New research need on sustainable agriculture and new innovation on sustainable agriculture.	1. Study on allelopathic effect on crop and new research on sustainable agriculture.

SW-1 Suggested Sessional Work(SW):

Assignments:

Role of non-monetary Inputs and low cost technologies; research need on sustainable agriculture

c. Other Activities (Specify):

New Research on sustainable agriculture

Agron511.4 Students will able to acquaint knowledge to Crop diversification, role of organic matter in maintenance of soil Fertility, crop residue management and nutrient use efficiency.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	0
SW	1
SL	1
Total	8

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Crop diversification for sustainability **SO1.**2 Understand the organic farming and role of organic farming to maintain soil Fertility **SO1.3** Understand the crop residue management; fertilizer use efficiency. **SO1.4**.Understand the fertilizer Use in intensive cropping system. **SO1.5**Understand the advanced nutritional tools for big data analysis and interpretation.		**Unit-4 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.** **1.1**Introduction toCrop diversification. **1.2**.diversification of crop and its importance for sustainability**.** **1.3**.Introduction to organic farming and its role in sustainable agriculture and to maintain soil Fertility **1.4** Introduction to management of crop residue and nutrient use efficiency. **1.5** The fertilizer Use in intensive cropping system. **1.6** Advanced nutritional tools for big data analysis and interpretation**.**	1. Study on crop diversification and importance of organic farming for the sustainable agriculture.

SW-1 Suggested Sessional Work(SW):

Assignments:

Crop diversification for sustainability; role of organic matter in maintenance of soil Fertility; crop residue management; fertilizer use efficiency

d. Other Activities(Specify):

Research on nutrient use efficiency. .

Agron511.5PG students will become expert in Plant ideotypes for drylands plant growth regulators and their role in sustainability.

Approximate Hours

Item	Appx Hrs.
Cl	04
LI	0
SW	1
SL	1
Total	6

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Plant ideotypes. **SO1.2**Understand the Plant ideotypes for drylands agriculture. **SO1.3** Understand the plant growth regulators **SO1.4**.Understand the plant growth regulator and their role in sustainability. .		**Unit-5Plantideotypes for drylands; plant growth regulators and their role in sustainability**. **1.1**Introduction toPlant ideotypes. **1.2.1**Introduction toPlant ideotypes for drylands agriculture. **1.3**.Introduction toplant growth regulators. **1.4** Introduction tothe plant growth regulator and their role in sustainability	1.Study on plant ideotypes and growth regulators.

SW-1 Suggested Sessional Work(SW):

Assignments: Plant ideotypes for drylands; plant growth regulators and their role in sustainability

e. Other Activities (Specify):

Study on plant growth regulators and their role in sustainability.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
Agron511.1 Students acquaint will familiar with the knowledge of Cropping systems physical resources, soil and water management in cropping systems.	05	0	01	01	07
Agron511.2 students will able to acquaints knowledge about Concept of sustainability in cropping systems and farming systems and types of cropping system and its advantages	08	0	02	01	11
Agron511.3 Students will able to identify the interactions and allelopathic effects; competition relations and become become expert in calculate the monetary returns.	06	0	01	01	08
Agron511.4 Students will able to acquaint knowledge to Crop diversification, role of organic matter in maintenance of soil Fertility, crop residue management and nutrient use efficiency	06	0	01	01	08
Agron511.5PG students will become expert in Plant ideotypes for drylands plant growth regulators and their role in sustainability	04	0	01	01	06
Total Hours	29	0	06	05	41

suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Cropping systems physical resources, soil and water management in cropping systems; assessment of land use	03	01	01	05
CO-2	Concept of sustainability in cropping systems and farming systems production potential under monoculture cropping, multiple cropping, Alley cropping, sequential cropping and intercropping, mechanism of yield advantage In intercropping systems.	02	06	02	10
CO-3	Above and below ground interactions and allelopathic effects low cost technologies; research need on sustainable agriculture.	03	07	05	15
CO-4	Crop diversification role of organic matter in maintenance of soil Fertility; fertilizer use efficiency Advanced nutritional tools for big data analysis And interpretation	05	05	05	15
CO-5	Plant ideotypes for drylands; plant growth regulators and their role in sustainability	01	02	02	05
Total		11	26	13	50

Legend: ***R:Remember,*** ***U:Understand,*** ***A:Apply***

The end of semester assessment for Cropping systems and sustainable agriculture to will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different task sapper requirement, for end semester assessment.

Suggested Instructional/ Implementation Strategies:

1. Improved Lecture
2. Tutorial

3. Case Method
4. Group Discussion
5. Role-play
6. Visit to field
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming.

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Cropping systems and sustainable agriculture.	panda sc.	Agronbios (india)	2017.
2	. Cropping systems in the tropics; principles and Management.	palaniappansp and sivaraman k.	New age.	1996
3	Cropping and farming systems.	panda sc.	Agronbios.	2003.
4	Principles of crop production.	reddy sr.	Kalyani	2000

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Cos, POs, and PSOs Mapping
Course Code:-Agron- 511
Course Title: -Cropping Systems and Sustainable Agriculture

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge disseminati on regarding various technique of farming and farming system in India	Wide knowle dge in the concern ing subject which will improve the farmers conditio n through student' s contribu tions.	Detailed knowled ge regardin g package and practices soil fertilizer and water manage ment of producti ve crop aspects.	Use appr opri ate scie ntifi c meth ods colla bora tion with stati stics alon g with eval uatio n whic h will prov ed to deci	Detail ed knowl edge of cultiva tion practic es, soil, fertiliz ers, water manag ement and plant protec tion econo mic associ ated with farmin g enterp	Create, select and apply an appropr iate techniq ues, resourc es and modern it tools in improv ement of agrono mical packag e and practic es.	Student will apply various statistic al method s to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understan d the impact of the professional expert solutions in societal and environme ntal contexts, and demonstrat e the knowledge of, and need for sustainable developme nt in Agricultur e.	Enable to recognize and examine the relationshi ps between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprene urship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrati ve and consultancy services.	Apply researc h and experti se in resolvi ng the proble ms of existin g farm in the periphe ry of univers ities.	To understa nd and analyze the current issues that are occurrin g in local and global agricultu re and how they will affect futuristic agricultu re

				sion in various part of agriculture	rises.									
CO1- Students acquaint will familiar with the knowledge ofCropping systemsphysical resources, soil and water management in cropping systems.	1	3	3	1	1	3	3	1	3	2	1	1	3	3
CO2 students will able to acquaints knowledge aboutConcept of sustainability in cropping systems and farming systems and	1	1	3	3	1	3	2	1	1	3	1	3	3	1

types of cropping system and its advantages.														
CO3 Students will able to identify the interactions and allelopathic effects; competition relations and become become expert in calculate the monetary returns	3	2	1	1	3	1	3	3	2	1	1	2	1	2
CO 4 Students will able to acquaint knowledge to Crop diversificatio n ,role of organic matter in maintenance of soil Fertility, crop	3	2	1	1	3	3	2	1	1	3	1	3	2	3

residue management and nutrient use efficiency.														
CO5PG students will become expert in Plant ideo types for dry lands plant growth regulators and their role in sustainability.	3	2	1	1	3	1	3	1	3	2	1	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map:Cropping Systems and Sustainable Agriculture

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO1-Students acquaint will familiar with the knowledge of Cropping systems physical resources, soil and water management in cropping systems.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit-1**.Cropping systems: definition, indices and its importance; physical resources, soil And water management in cropping systems; assessment of land use. 1.1, 1.2,1.3,1.4,1.5.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO2 students will able to acquaints knowledge about Concept of sustainability in cropping systems and farming systems and types of cropping system and its advantages.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-2** 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. 1.1, 1.2,1.3,1.4,1.5, 1.6, 1.7, 1.8	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO3Students will able to identify the interactions and allelopathic effects; competition relations and become become	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-3**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.	As mentioned in page number ……..

	expert in calculate the monetary returns			1.1, 1.2,1.3,1.4,1.5, 1.6	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO 4 Students will able to acquaint knowledge to Crop diversification ,role of organic matter in maintenance of soil Fertility, crop residue management and nutrient use efficiency.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 4**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. 1.1, 1.2,1.3,1.4 1.5, 1.6	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO5PG students will become expert in Plant ideotypes for dry lands plant growth regulators and their role in sustainability.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit 5** Plant ideotypes for dry lands; plant growth regulators and their role in sustainability. 1.1, 1.2,1.3,1.4	As mentioned in page number ……..

AKS University

Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code: **SOIL 506**

Course Title : **Soil Biology And Biochemistry**

Pre- requisite: Student should have basic knowledge of bio fertilizers and useful microorganisms available in soil help in transforming the fixed forms of nutrients . They know about the various organic waste (plant /animal/rural and urban wastes).

Rationale: The Student learn about available soil microorganisms help in dissolving the fixed form of plant essential nutrients absorbed by the crop. Transformation and lifecycle of all essential plant nutrients. The manufacturing of various bio fertilizers available in market, their composition, combination, properties and use. Importance, principle and role organic farming with the use of consortium for maintaining fertility and sustainability in soil.

Course Outcomes:

Soil 506.1: They understand about the Diversity of microbes in soil, their ecosystem and life cycle.
Soil 506.2: To relate the various interaction of soil microbes with crop and their transformation process in soil.
Soil 506.3: To recollect and implement the knowledge of various methods of biodegradation of pesticides, organic wastes and their use for production of biogas,
Soil 506.4: To practices the manufacturing of various forms of organic manures, and bio fertilizers with its application use and importance in maintain soil health.
Soil 506.4: To practices the manufacturing,application of organic manure and bio fertilizers in soil

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	Soil 506	Soil Biology and Biochemistry	2	1	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) andTutorial(T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C:Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome ofLearning.

Scheme of Assessment:

Theory

Course Category	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
PCC	Soil 506	Soil Biology and Biochemistry	15	30	0	0	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Soil 506.1: To classification of soil biota, its ecosystem and various interaction occurs with

soil organisms

Approximate Hours

Item	AppXHrs
Cl	05
LI	4
SW	2
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1: It gives General introduction on bio fertilizers, its use and importance. **SO1.2:**To recall the diversity in soil microbes, there ecosystem and life cycle **SO1.3** To learn the different interactions occurs between soil and soil organisms	**1.1** Determination of soil microbial population **1.2** To estimate the Soil microbial biomass	**Unit-1 General introduction about soil biota, its ecosystem and various interaction occurs with soil organisms** **1.1** Classification of soil biota and its ecosystem **1.2** Classification of soil microbes **1.3** Importance of soil biota in ecosystem **1.4** Role of soil organisms **1.5** Interaction process occurs with soil organisms	1. To know about various types of soil organisms

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Enlist the classification of soil microbes
- Define soil biota its population and ecosystem

b. MiniProject:

c. Other Activities(Specify): NA

Soil 506.2: To learn the various interactions of soil microbes with plants**.**

Approximate Hours

Item	AppXHrs
Cl	5
LI	4
SW	2
SL	0
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 To relate the different types of interaction of soil microbes with crop, there growth **SO2.2**To understand the principle and role of soil microbes **SO2.3** To discriminate the various enzymes and chemicals released by the microbes.	1. Determination of Soil enzymes released by soil microbes 2. To Study therhizosphere effect in different crops	**Unit : 2: The basic concept , importance and role of soil microbes** **2.1** To learn the classification of soil microbes **2.2** To understand the role of soil microbes in increasing soil fertility **2.3** To know the various enzymes released by the microbes **2.4** To learn the various chemicals reactions affecting the growth of microbes in soil **2.5** Classification of different Rhizo-bacteria in soil used in different crops	

SW-2 Suggested Sessional Work(SW):

a. Assignments:

- Classification, composition and properties of major nutrient fertilizers.

b. Mini Project:

- Prepare flow chart of integrated nutrient management

c. Other Activities(Specify): NA

Soil 506 .3: To understand transformation of nutrients with various interaction of soil organism and formation of humus

Approximate Hours

Item	AppXHrs
Cl	5
LI	10
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)

SO3.1 To learn the various process involved during transformation of different nutrients(macro, secondary and micro nutrients) through microbial activity in soil **SO3.2 To** Understand and learn the nutrient cycle. **SO3.3 To assess the a**bility to understand the Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.	1. Measurement of important soil microbial processes such as ammonification, nitrification, N2 2. To study the determination of fixation of various nutrients in soil 3. To determine the process involved in S oxidation 4. Estimation of Phosphorus solubilization and mineralization 5. Estimation of micro nutrients solubilization and mineralization	**Unit-3 :** Transformation solubilization and mineralization of essential plant nutrient **3.1**Microbial transformation of Major nutrients **3.2**Microbial transformation of secondary and Micro nutrients **5.3** Role of soil organic matter and crop residue in maintaining soil fertility and productivity **5.4** Formation and components of humus **5.5** To learn the importance of humus in maintaining soil fertility	1. Making chart of available forms to essential plants nutrients

SW-3 Suggested Sessional Work (SW):

a. Assignments:

- Humus formation its classification and components
- Transformation of soil nutrients and factor affecting each of them

b. Other Activities(Specify): NA

Soil 506 .4: Identification, production, role , importance and use of bio pesticides , organic waste its degradation process and manure application in various crop for sustainable agriculture

Approximate Hours

Item	AppXHrs
Cl	6
LI	8
SW	2
SL	2
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**

SO4.1 To Relate difference between the Biodegradation of pesticides, **SO4.2 To** Understand and learn the production and use of organic wastes and manures. **SO4.3 To** Understand and learn the production and use of biogas plant and use of slurry in increasing the sustainability of soil	1. Elemental composition, of organic matter 2. Elemental composition, functional groups 3. To study the fractionation of organic matter 4. To study the fractionation of functional groups	**Unit-4:** Production, role and Importance of various bio pesticides, degradable substances and organic waste **4.1** To learn the Production techniques of biodegradable pesticides **4.2:** To know the application methods of biodegradable pesticides in maintaining soil health and increase the crop yield **4.3:** To understand the role of biodegradable pesticides in maintaining soil health **4.4**. Role of various microbial toxins released in soil **4.5.** Production, importance and use of organic waste **4.6.** Role of various biotic factors involved in soil developments	1. Making chart of useful bio pesticide available in market 2. Identification of different organic manures and nutrient content in it

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**

- Identification of different organic manures and nutrient content in it

b. Mini-Project

- Preparation of flow chart of identification of various bio pesticides and its application in different crop

Other Activities(Specify): NA

Soil 506**.5: Role, importance , preparation and properties of various organic manure and bio fertilizer if different crop to maintain the sustainability of soil**

Item	AppXHrs
Cl	5
LI	2
SW	2
SL	1
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**

SO5.1 To know the Effective knowledge on formation and application method of different types of compost, FYM, Vermicomposting. **SO5.2**Understand the procedure , importance, and classification of different Bio fertilizers	1. Decomposition of organic matter in soil	**Unit5:Application and preparation of organic manure and bio fertilizers in soil** **5.1** To learn the preparation methods of different bulky organic manures **5.2:** To learn the preparation methods of different concentrated organic manures **5.3**Classification and preparation of various bio fertilizers **5.4:** To learn theApplication method used during supply of various bio fertilizers in different crops **5.5** Application of different organic manure and bio fertilizer in improving crop production.	1. Enlist the different Methods of organic waste and bio fertilizer available in market

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- Preparation Methods of different organic manure in various crops.

b. MiniProject:

c. **OtherActivities(Specify): NA**

SW-5 Suggested Sessional Work (SW):

d. Assignments:

- Preparation Methods of different organic manure in various crops.

b. MiniProject

OtherActivities(Specify): NA

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+LI+SW+Sl)
Soil 506.1: **To classification of soil biota, its ecosystem and various interaction occurs with soil organisms**	5	4	2	2	09
Soil 506..2: **To learn the various interactions of soil microbes with plants.**	7	4	2	2	11
Soil 506 .3: **To understand transformation of nutrients with various interaction of soil organism and formation of humus**	7	10	2	1	10
Soil 506..4: **Identification,**	6	8	2	2	10

production, role , importance and use of bio pesticides , organic waste its degradation process and manure application in various crop for sustainable agriculture					
Soil 506.5: **: Role, importance , preparation and properties of various organic manure and bio fertilizer if different crop to maintain the sustainability of soil**	5	2	2	1	08
Total Hours	30	30	30	8	48

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	General introduction about soil biota, its ecosystem and various interaction occurs with soil organisms	03	01	01	05
CO-2	The basic concept , importance and role of soil microbes	02	06	02	10
CO-3	Transformation solubilization and mineralization of essential plant nutrient	03	07	05	15
CO-4	Production, role and Importance of various bio pesticides, degradable substances and organic waste	03	07	05	15
CO-5	Application and preparation of organic manure and bio fertilizers in soil	03	02	-	05
Total		11	26	13	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment for Soil Biology and Biochemistry will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.

Teachers can also design different tasks as per requirement, for end semester assessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Onlinesources)
8. Brainstorming

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Introduction to Soil Microbiology	Alexander M	John Wiley & Sons	1977
2	Soil Biology	Burges A & Raw F	Academic Press	1967
3	Soil Biochemistry	McLaren AD & Peterson GH	Vol. XI. Marcel Dekker	1967
4	Soil Microbial Ecology – Applications in Agricultural and Environmental Management.	Metting FB.	ICAR, New Delhi	1993
5	Soil Biochemistry	Paul EA and Ladd JN.	Marcel Dekker	1981
6	Soil Organisms and Litter in the Tropics	Reddy MV. (Ed.).	Oxford & IBH	-
7	Plant Root System: Their Functions and Interaction with the Soil.	Russel RS	ELBS & McGraw Hill.	1977
8	Soil Biochemistry	Stotzky G &Bollag JM	Vol. VIII. Marcel Dekker	1993
9	Principles and Applications of Soil Microbiology.	Sylvia DN.	Pearson Edu	2005
10	Soil and the Environment - An Introduction	Wild A	Cambridge Univ. Press	1993
11	Fundamental of Soil Science	Indian Society of Soil Science	ISSS, National Societies Block, Pusa, New Delhi	Revised 2012
12	Soil Microbiology	SubbaRao N.S	Medtech Scientific International	Revised 2017

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Cos, POs and PSOs Mapping
Course Code:-SOIL- 506
Course Title: - Soil Biology and Biochemistry

Course Outcomes	**Program Outcomes**									**Program Specific Outcome**				
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with eva	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				luation which will proved to decision in various part of agriculture	economic associated with farming enterprises.	and practices.				agri Entrepreneurship.				
CO1They understand about the Diversity of microbes in soil, their ecosystem and life cycle.	3	1	1	1	3	1	3	3	1	3	1	2	3	1

CO2 To relate the various interaction of soil microbes with crop and their transformation process in soil.	3	3	3	3	1	1	1	3	1	3	3	1	2	1
CO3To recollect and implement the knowledge of various methods of biodegradation of pesticides, organic wastes and their use for production of biogas	3	2	3	1	1	1	3	1	3	3	2	2	1	2
CO 4 To practices the	3	1	1	1	3	1	3	3	1	3	1	3	2	1

manufacturing of various forms of organic manures, and bio fertilizers with its application use and importance in maintain soil health.														
CO5To practices the manufacturing,application of organic manure and bio fertilizers in soil	3	3	1	1	1	3	1	1	3	1	1	1	3	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Soil Biology and Biochemistry

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO1 They understand about the Diversity of microbes in soil, their ecosystem and life cycle.	**SO1.1 SO1.2 SO1.3**		Unit-1.General introduction about soil biota, its ecosystem and various interaction occurs with soil organisms 1.1, 1.2,1.3,1.4,1.5.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO2 To relate the various interaction of soil microbes with crop and their transformation process in soil.	**SO1.1 SO1.2 SO1.3**		Unit-2 The basic concept , importance and role of soil microbes 1.1, 1.2,1.3,1.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO3To recollect and implement the knowledge of various methods of biodegradation of pesticides, organic wastes and their use for production of biogas	**SO1.1 SO1.2 SO1.3**		Unit-3 Transformation solubilization and mineralization of essential plant nutrient 1.1, 1.2,1.3,1.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO 4 To practices the manufacturing of various forms of organic manures, and bio fertilizers with its application use and importance in maintain soil health.	**SO1.1 SO1.2 SO1.3**		Unit 4 Production, role and Importance of various bio pesticides, degradable substances and organic waste 1.1, 1.2,1.3,1.4 1.5, 1.6	As mentioned in page number ……..

PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO5To practices the manufacturing,application of organic manure and bio fertilizers in soil	**SO1.1** **SO1.2**		Unit 5 Application and preparation of organic manure and bio fertilizers in soil 1.1, 1.2,1.3,1.4 1.5	As mentioned in page number ……..

AKS University
Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code:	**SOIL 508**
Course Title :	**Soil water and air pollution**
Pre- requisite:	Student should have basic knowledge of various forms of pollutants present in soil, water and air.
Rationale:	The Student learn about the measurement of soil, water and air pollution , their optimum level. What are the norms to reduce the pollution from soil, air and water used by government in India and world for maintaining ecofriendly nature.

Course Outcomes:

Soil 508.1: To identify the problems occur in agriculture sector regarding polluted water, air and soil their mode of occurrence and extended level

Soil 508.2: To learn the Nature , sources and effect of various pollutants on fertility, production and productivity of soil and crop including human health

Soil 508.3: Assess the forms and properties of various effluents released from Sewage and different industrial waste their by effect on growth of living organisms

Soil 508.4: Classification and behavior of pesticides in soil, and their effect on soil microorganisms

Soil 508.5: To understand the sources and behavior of released toxic substances affect in Soil, water , Air and human health

Soil 508.6: To understand the sources and reclamation tactics in managing the effect of release of GH gasses contribution and pesticide on reducing Soil, plant, water and Air

Soil 508.7: Risk assessment of polluted soil and reclamation of contaminated Soil, water , Air and human health

Scheme of Studies:

Course Category	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	

ProgramCore (PCC)	Soil 509	Soil water and air pollution	2	2	1	1	5	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial(T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,**C:**Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome ofLearning.

Scheme of Assessment:

Theory

Course Category	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ESA)
ProgramCore (PCC)	Soil 509	Soil, water and air pollution	15	30	0	0	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Soil 508 .1: Toidentify the problems occur in agriculture sector regarding polluted water, air and soil their mode of occurrence and extended level

Approximate Hours

Item	AppXHrs
Cl	4
LI	2
SW	2
SL	1
Total	09

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1: To recall the various types of pollution and there sources **SO1.2:**To discriminate the different types of pollution occur in agricultural field, their source.	1.To determine the BOD of a given water sample	**Unit-1Source of air, water and soil pollution which affect the crop production** 1.1 Understand the various types and source of soil pollution 1.2 Understand the various types and source of water pollution 1.3 Understand the various types and source of air pollution 1.4 Effect of soil , water and air pollution on growth and development of crop	1. To know about various pollutants and their sources of soil , water and air pollution

SW-1 Suggested Sessional Work (SW):

a) Assignments:

Enlist the various pollutants affecting soil , water and air

b) MiniProject: NA

c) Other Activities(Specify): NA

Soil 508. .2: To learn the Nature , sources and effect of various pollutants on fertility, production and productivity of soil and crop including human health

Approximate Hours

Item	AppXHrs
Cl	4
LI	6
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 To assess the nature and sources of pollutants originates from agricultural field (through fertilizers and pesticides) **SO2.2** To assess the nature and sources of pollutants originates from, industrial area, **SO2.3** To assess the nature and sources of pollutants originates from urban wastes lands, acid rains.	1. To determine the nitrate and ammonium nitrogen content of a given soil, and water sample 2.To determine the available phosphorus content in a give soil and water sample 3. To determine the available heavy metal content in given soil /water effluents	**Unit-2.0 To Study the Soil, water and air pollution and there problems** **1.1** To discuss about the Soilpollution. **1.2** To discuss about the water pollution. **1.3** To discuss about the air pollution. **1.4** To Learn the problems associated with agriculture, nature contaminating the soil, water and plant	1.Enlist the various role of fertilizers, pesticides and herbicides in increasing the Soil, water and air pollution

SW-2 Suggested Sessional Work(SW):

Assignments:

1. Enlist the nature and sources of pollutants originates from urban wastes lands,
2. Factors responsible in cause of acid rains

a. Mini Project:

b. Other Activities(Specify): NA

Soil 508.3: Assess the forms and properties of various effluents released from Sewage and different industrial waste their by effect on growth of living organisms

Approximate Hours

Item	AppXHrs
Cl	4
LI	6
SW	2
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Evaluate the effect of sewage water on plant growth and human beings **SO3.2 To** Understand the effect of industrial effluents on growth and development of living beings	1. To know the Sampling method and precaution measure should be taken during colleting sewage waters and sludge 2. To know the Sampling method and precaution measure should be taken during colleting the solid/liquid industrial waste, 3. To know the Sampling method and precaution measure should be taken during colleting polluted soils and plant	**Unit-3 : To understand the forms and properties of various effluents released from Sewage and industrial** 3.1 To learn about Sewage effluents–their composition 3.2 To learn about industrial effluents–their composition 3.3 To understand the effect of Sewage &industrial effluents on soil properties/ health, and plant growth and human beings. 3.4 To understand the soil as sink for waste disposal	1. to know about the various industries running in your surrounding and their discarded material

SW-3 Suggested Sessional Work (SW):

a) Assignments:

Effect of industrial effluents on growth and development of living beings

b) Other Activities(Specify): NA

Soil 508:4: Classification and behavior of pesticides in soil, and their effect on soil microorganisms

Approximate Hours

Item	AppXHrs
Cl	4
LI	2
SW	2
SL	2
Total	10

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Recognize the different type of Pesticides and available nutrients. **SO4.2** Relate the behavior of pesticides and available nutrients in soil with different crops	1. Management of contaminants in soil and plants to safeguard food safety	**Unit-4: Study the pesticides–their classification, and soil microorganisms.** 4.1 To study the classification of Pesticides 4.2 To learn the effect of Pesticides in soil properties 4.3 To learn the effect of Pesticides on growth and development of soil microorganisms. 4.4 To understand the effect of Pesticides on growth and development of crop	1. Making chart of useful bio pesticide available in market 2. Identification of different banned pesticides but still supplied in market

SW-4 Suggested Sessional Work (SW):

a. **Assignments:**
   1. Role of pesticides in affecting the population of useful microorganisms
b. Other Activities(Specify): NA

Soil 508.5: To understand the sources and behavior of released toxic substances affect in Soil, water , Air and human health

Item	AppXHrs
Cl	4
LI	4
SW	2
SL	1
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 To identify the various sources and behavior of released of release of toxic substances in soil **SO5.2**To identify the various sources and behavior of released of toxic substances in plants SO5:3. To identify the various sources and behavior of released of toxic substances in human beings	1. Air sampling and determination of particulate matter and oxides of sulphur 2. Visit to various industrial sites to study the impact of pollutants on soil and plants	**Unit-5: Study the Toxic elements and there management .** 5.1 To learn about different types of Toxic elements present in soil 5.2 To learn the different sources of Toxic elements present in soil 5.3 To learn the behavior of different Toxic elements present in soil 5.4 Understand the effect on nutrients availability, effect on plant and human health.	1. Enlist the different types of toxic substances affect the soil, water and air

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- Enlist the various sources and behavior of released of toxic substances in soil and plants
- Enlist the various sources and behavior of released of toxic substances in water
- Enlist the various sources and behavior of released of toxic substances in Air
- Enlist the various sources and behavior of released of toxic substances in human beings

b. MiniProject:

- Llist of toxic substances released from various industries affect the soil, water and air

OtherActivities(Specify): NA

Soil 508.6: To understand the sources and reclamation tactics in managing the effect of release of GH gasses contribution and pesticide on reducing Soil, plant, water and Air

Item	AppXHrs
Cl	5
LI	4
SW	2
SL	1

Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO6.1 To review on cause of Pollution of water resources and its reclamation strategies **SO6.2**To understand the cause of release of GH gasses and its reclamation strategies SO6:3. To identify the forms of pesticides affect the soil health	1. To determine the other heavy metals in soils sample 2. To determine the Heavy metals in contaminated plants sample	**Unit .6: Study the pollution of water and green house gasses.** 6.1 To learn about the various ways of water Pollution resources due to leaching of nutrients and pesticides from soil. 6.2 To learn about the various ways of water Pollution resources due to effect of pesticides in soil 6.3 To understand the various sources responsible in emission of green house gases– carbon dioxide, methane and nitrous oxide in atmosphere 6.4 To know the emission of green house gases–carbon dioxide, methane and nitrous oxide 6.5 To study the different practices to manage both water and air pollution through leaching and emission of GHG respectively	1. Enlist the various GH Gases and their contribution in depletion of ozone layer of earth

SW-5 Suggested Sessional Work (SW):

a) Assignments:
Identify the sources of GH gasses its contribution in affecting the ozone layer depletion

b) **MiniProject: NA**

c) **OtherActivities(Specify): NA**

Soil 508.7: Risk assessment of polluted soil and reclamation of contaminated Soil, water , Air and human health

Item	AppXHrs
Cl	5
LI	6
SW	2
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO7.1 To assess the soil pollution **SO7.2**To reclamation the polluted soil, and water SO7:3. To learn the use of remote sensing in assessing the management of polluted soil and water	1.Estimation of dissolved and suspended solids in water. 2.To determine the chemical oxygen demand (COD) of a given water sample 3. To determine the Dissolved oxygen (DO) of a given water sample	**Unit-7: Study the polluted contaminated soil and water and there management** 7.1 To learn about the Risk assessment of polluted soil 7.2 Remediation/ amelioration of contaminated soil and water 7.3 Remediation/ amelioration of contaminated water 7.4 To know the remote sensing applications in monitoring 7.5 To know the remote sensing applications in management of soil and water pollution.	1. To learn the use of interment and basic computer knowledge in operating GIS software

SW-5 Suggested Sessional Work (SW):

b. Assignments:

1. To use the remote sensing in assessing the management of polluted soil and water and locating techniques in map

b. MiniProject:

OtherActivities(Specify): NA

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
Soil 508.1 To identify the problems occur in agriculture sector regarding polluted water, air and soil their mode of occurrence and extended level	4	2	2	1	9
Soil 508.2 To learn the Nature , sources and effect of various pollutants on fertility, production and productivity of soil and crop including human health	4	6	2	1	13
Soil 508.3 Assess the forms and properties of various effluents released from Sewage and different industrial waste their by effect on growth of living organisms	4	6	2	1	13
Soil 508.4 Classification and behavior of pesticides in soil, and their effect on	4	2	2	2	10

soil microorganisms					
Soil 508.5 To understand the sources and behavior of released toxic substances affect in Soil, water , Air and human health	4	4	2	1	11
Soil 508.6 To understand the sources and reclamation tactics in managing the effect of release of GH gasses contribution and pesticide on reducing Soil, plant, water and Air	5	4	2	1	12
Soil 508.7 Risk assessment of polluted soil and reclamation of contaminated Soil, water , Air and human health	5	6	2	1	14
Total Hours	30	30	15	8	82

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Source of air, water and soil pollution which affect the crop production	03	02	02	07
CO-2	To Study the Soil, water and air pollution and there problems	02	03	03	8
CO-3	To understand the forms and properties of various effluents released from Sewage and industrial	03	03	02	8
CO-4	Study the pesticides–their classification, and soil microorganisms.	02	02	03	7
CO-5	Study the Toxic elements and there management	03	02	02	7
CO-6	Study the pollution of water and green house gases	02	02	02	6
CO-7	Study the polluted contaminated soil and water and there management	03	02	02	7
Total		18	16	16	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment for Soil Water and Air Pollution will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks.Teachers can also design different tasks as per requirement, for end semesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. RolePlay
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Onlinesources)
8. Brainstorming

Suggested Learning Resources:

(a) Books :

S.No.	Title	Author	Publisher	Edition & Year
1	Soil Management and Greenhouse Effect	Lal R, Kimble J, Levine E and Stewart BA.	CRC Press	1995
2	. Industrial Pollution Control	Middlebrooks EJ.	John Wiley Interscience	1979
3	Toxic Metals in Soil Plant Systems.	Ross SM.	John Wiley & Sons	-
4	Environmental Pollution and Control	Vesilund PA and Pierce	Ann Arbor Science Publication	1983
5	Fundamental of Soil Science	Indian Society of Soil Science	ISSS, National Societies Block, Pusa, New Delhi	Revised 2012
6	The Nature and properties of Soils	Nyle B Brady and Ray R Weil	Pearson Education	Revised 2013

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Cos, POs and PSOs Mapping
Course Code:- SOIL 508
Course Title: - Soil water and Air Pollution

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation whi	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practi	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				ch will proved to decision in various part of agriculture	enterprises.	ces.								
CO-1 To identify the problems occur in agriculture sector regarding polluted water, air and soil their mode of occurrence and extended level	1	3	3	1	2	1	3	3	3	3	1	2	3	1
CO-2 To learn	3	1	3	3	1	2	1	3	3	1	1	3	2	1

the Nature , sources and effect of various pollutants on fertility, productio n and productiv ity of soil and crop including human health														
CO-3 Assess the forms and properties of various effluents released from Sewage and different industrial waste their by effect on growth of living organism s	1	3	3	1	2	1	3	3	1	3	2	2	1	2

CO-4 Classification and behavior of pesticides in soil, and their effect on soil microorganisms	3	2	1	3	1	3	1	3	3	1	2	1	3	1
CO-5 To understand the sources and behavior of released toxic substances affect in Soil, water , Air and human health	3	1	2	1	3	3	1	1	2	1	3	1	3	1
CO-6 To understand the sources and	3	2	2	1	3	3	1	1	2	1	3	1	3	1

reclamation tactics in managing the effect of release of GH gasses contribution and pesticide on reducing Soil, plant, water and Air														
CO-7 Risk assessment of polluted soil and reclamation of contaminated Soil, water , Air and human health	3	2	2	1	3	3	1	1	2	1	3	1	3	1

Legend: 1 – Low, 2 – Medium, 3 – Hig

Course Curriculum Map: Soil water and Air Pollution

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO-1** To identify the problems occur in agriculture sector regarding polluted water, air and soil their mode of occurrence and extended level	**SO1.1** **SO1.2** **SO1.3**		Unit 1 Source of air, water and soil pollution which affect the crop production 1.1,1.2,1.3,1.4,	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO-2** To learn the Nature , sources and effect of various pollutants on fertility, production and productivity of soil and crop including human health	**SO1.1** **SO1.2** **SO1.3**		Unit 2 To Study the Soil, water and air pollution and there problems. 1.1,1.2,1.3,1.4	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO-3** Assess the forms and properties of various effluents released from Sewage and different industrial waste	**SO1.1** **SO1.2**		Unit 3 To understand the forms and properties of various effluents released from Sewage and industrial 1.1,1.2,1.3,1.4	As mentioned in page number ……..

	their by effect on growth of living organisms				
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO-4** Classification and behavior of pesticides in soil, and their effect on soil microorganisms	**SO1.1** **SO1.2**		Unit 4 Study the pesticides–their classification, and soil microorganisms. 1.1,1.2,1.3	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO-5** To understand the sources and behavior of released toxic substances affect in Soil, water , Air and human health	**SO1.1** **SO1.2** **SO1.3**		Unit 5 Study the Toxic elements and there management 1.1,1.2,1.3,1.4	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO-6** To understand the sources and reclamation tactics in managing the effect of release of GH gasses contribution and pesticide on reducing Soil, plant, water and Air	**SO1.1** **SO1.2** **SO1.3**		Unit 6 Study the pollution of water and green house gases. 1.1,1.2,1.3,1.4,1.5	

PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO-7** Risk assessment of polluted soil and reclamation of contaminated Soil, water , Air and human health	**SO1.1** **SO1.2** **SO1.3**		Unit 7 Study the polluted contaminated soil and water and there management. 1.1,1.2,1.3,1.4,1.5	

AKS University

Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code: **STAT-502**

Course Title: **Statistical Methods for Applied Science**

Pre-requisite: Statistical knowledge helps you use the proper methods to collect the data, employ the correct analyses, and effectively present the results. Statistics is a crucial process behind how we make discoveries in science, make decisions based on data, and make predictions.

Rationale: Statistical methods involved in carrying out a study include planning, designing, collecting data, analysing, drawing meaningful interpretation and reporting of the research findings. The statistical analysis gives meaning to the meaningless numbers, thereby breathing life into a lifeless data.

Course Outcomes:

CO1 This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.

CO2 It can be used to find the best solution to any problem be it simple or complex.

CO3 Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.

CO4 To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.

CO5 Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	STAT-502	Statistical Methods for Applied Science	2	01	02	01	6	3

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self Learning,

C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)						
			Progressive Assessment (PRA)					End Semester Assessment	Total Marks
			Class/Home Assignment 1 number 5 marks each (CA)	Class Test 2 (2 best out) 15 marks each (CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT+PA+AT)	(ESA)	(PRA+ESA)
PCC	STAT-502	Statistical Methods for Applied	5	30	10	5	50	50	100

		Science							

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

STAT-502 CO-1 Know the applications of Statistics and learn and apply these techniques in the agriculture field.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	2
SW	1
SL	2
Total	11

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Apply laws of probability to concrete problems. **SO1.2** Perform statistical inference in several circumstances and interpret the results in an applied context. **SO1.3** Communicate concepts in probability and statistics using both technical and non-technical language**.** **SO1.4** Use a statistical software package for computations with data,	1) To impart knowledge on Statistical concepts like Exploratory data analysis.	**Unit-1.** Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation. **1.1**. Box-plot **1.2** Descriptive statistics **1.3** Exploratory data analysis **1.4** Theory of probability. **1.5** Random variable **1.6**Mathematical expectation**.**	1. Prepare the assignment on Random variable and mathematical expectation.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Random variable and mathematical expectation.

b. Mini Project: -

c. Other Activities (Specify):-

STAT-502 CO-2 Find the best solution to any problem be it simple or complex.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	8
SW	1
SL	2
Total	17

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Recognize the binomial probability distribution and apply it appropriately. **SO2.2** Recognize the Poisson probability distribution and apply it appropriately. **SO2.3** Recognize and understand discrete probability distribution functions, in general. **SO2.4** Recognize the standard normal probability distribution and apply it appropriately. **SO2.5** Compare normal probabilities by converting to the standard normal distribution.	1- Fitting of Binomial distributions. 2- Fitting of Poisson distributions. 3- Fitting of Negative Binomial distributions. 4- Fitting of Normal distributions.	**Unit-2** Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions. **1.1** Discrete and continuous probability distributions **1.2** Binomial, Poisson, Negative Binomial **1.3**. Normal distribution, Beta and Gamma distributions and their applications **1.4** Concept of sampling distribution: chi-square, *t* and *F* distributions. **1.5** Tests of significance based on Normal, chi-square. **1.6** Tests of significance based on *t* and *F* distributions.	1. Prepare the assignment on Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Simple Problems Based on Probability. Binomial & Poisson Distributions.

a. Other Activities (Specify):

STAT-502 CO-3 Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	6
SW	1
SL	2
Total	15

Session Out Comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Create and analyze scatter plots. **SO3.2** Discuss basic ideas of linear regression and correlation. **SO3.3** Create and interpret a line of best fit. **SO3.4** Calculate and interpret the correlation coefficient.	1- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F. 2- Large sample tests, testing of hypothesis based on exact sampling distributions ~t-test. 3- Large sample tests, testing of hypothesis based on	**Unit-3** Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. **1.1**. Definition of Correlation **1.2** Types of Correlation **1.3**. Scatter Diagram **1.4**. Karl Pearson's Coefficient of Correlation **1.5** Definition of Regression. **1.6**. Linear Regression Equations	1. Prepare the assignment on Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

	exact sampling distributions ~F- test.		

SW-1 Suggested Sessional Work (SW):
Assignments: Prepare the assignment on Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

b. Other Activities (Specify):

STAT-502 CO-4 understand the process of hypothesis testing and its significance. Testing of hypothesis using non-Parametric tests like Median test, runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.

Approximate Hours

Item	Appx Hrs.
CI	6
LI	8
SW	1
SL	2
Total	17

Session Out Comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Conduct and interpret hypothesis tests for a single population mean, population standard deviation known. **SO4.2** Conduct and interpret hypothesis tests for a single population mean, population	1- Confidence interval estimation and 2- Correlation analysis 3- Regression analysis 4- Fitting of	**Unit-4** Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table. **1.1** Introduction to Test of Significance **1.2** One sample	1. Prepare the assignment on Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table.

standard deviation unknown. **SO4.3** Describe hypothesis testing in general and in practice **SO4.4** Interpret the chi-square probability distribution as the sample size changes. **SO4.5** Conduct and interpret chi-square goodness-of-fit hypothesis tests.	Linear and Quadratic Model.	**1.3** Two sample test t for Means **1.4** Definition of Chi-Square **1.5** Application of Chi-square test **1.6** Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table	

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table

c. Other Activities (Specify):

STAT-502 CO-5 Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.

Approximate Hours

Item	Appx Hrs.
CI	6
LI	6
SW	1
SL	2
Total	15

Session Out Comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO5.1 Recognize and differentiate between key terms. **SO5.2** Apply various types of sampling methods to data	1- Non-parametric tests. 2- ANOVA: One way 3- ANOVA: Two Way	**Unit-5** Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration,	1. Prepare the assignment on Introduction to Analysis of Variance, Analysis of One Way

collection. **SO5.3** Create and interpret frequency tables.		Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample. **1.1** Introduction to Analysis of Variance **1.2**. Analysis of One Way Classification **1.3**. Introduction to Sampling Methods **1.4** Sampling versus Complete Enumeration **1.5** Simple Random Sampling with and without replacement **1.6** Use of Random Number Tables for selection of Simple Random Sample.	Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration.

SW-1 Suggested Sessional Work (SW):

Assignments:

Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (C l)	Laboratory Lecture (L I)	Sessional Work (SW)	Self Learning (S l)	Total hour (C l + LI+ SW +S l)
01: This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.	06	02	01	02	15
02: It can be used to find the best solution to any problem be it simple or complex.	06	08	01	02	15
03: Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.	06	06	01	02	15

04: To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.	06	08	01	02	15
05: Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.	06	06	01	02	15
Total Hours	**30**	**30**	**05**	**10**	**75**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit title	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO-1	This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study.	02	02	02	06
CO-2	It can be used to find the best solution to any problem be it simple or complex.	02	03	03	08
CO-3	Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank correlation coefficient, partial	02	04	04	10

	correlation coefficient and Multiple correlation coefficient.				
CO-4	To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.	03	04	05	12
CO-5	Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.	04	05	05	14
	Total	13	18	19	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Statistical Methods for Applied Science will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

S. No.	Title	Author	Publisher	Edition & Year
01	An Outline of Statistical Theory	Goon AM, Gupta MK & Dasgupta B.	The World Press	1977 1st addition
02	Fundamentals of Statistics	Goon AM, Gupta MK & Dasgupta B	The World Press	1983. First edition
03	Introduction to Mathematical Statistics	Hoel PG	John Wiley	05th Edition 1971
04	An Introduction to Multivariate Statistical Analysis	T.W. Anderson	John Wiley.	3rd Edition 2009
05	Introduction to Mathematical Statistics	Robert V. Hogg, Joseph W. McKean, Allen T. Craig	Hogg	7th Edition 2012

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Cos, POs and PSOs Mapping
Course Code:- STAT-502
Course Title: - Statistical Methods for Applied Science

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part of	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				agriculture										
CO1- This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study	1	2	1	1	1	3	3	3	3	3	1	2	3	3
CO2 It can be used to find the best solution to any problem be it simple or complex	1	2	1	1	1	3	3	3	3	3	1	2	3	3
CO3 Concept of correlation, various correlation coefficients- Pearson's correlation	1	2	1	1	1	3	3	3	3	3	1	2	3	3

coefficient, Spearman's rank correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.														
CO 4. To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them	1	2	1	1	1	3	3	3	3	3	1	2	3	3

judiciously for the testing of given data.														
CO5 Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.		2	1	1	1	3	3	3	3	3	1	2	3	3

Course Curriculum Map: Statistical Methods for Applied Science

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO1- This course will help students to know the applications of Statistics and learn and apply these techniques in the agriculture field of their study	**SO1.1 SO1.2 SO1.3 SO1.4**		**Unit-1**. Box-plot, Descriptive statistics, Exploratory data analysis, Theory of probability, Random variable and mathematical expectation. 1.1, 1.2,1.3,1.4,1.5,1.6	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO2 It can be used to find the best solution to any problem be it simple or complex	**SO2.1 SO2.2 SO2.3 SO2.4 SO2.5**		**Unit-2** Discrete and continuous probability distributions, Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions 1.1, 1.2,1.3,1.4,1.5,1.6	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO3 Concept of correlation, various correlation coefficients- Pearson's correlation coefficient, Spearman's rank	**SO3.1 SO3.2 SO3.3**		**Unit-3**. Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. 1.1, 1.2,1.3,1.4,1.5,1.6	As mentioned in page number ……..

	correlation coefficient, partial correlation coefficient and Multiple correlation coefficient.				
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO 4. To understand the process of hypothesis testing and its significance. Testing of hypothesis using Non-Parametric tests like Median test, Runs test, U test, Kruskal Wallis test etc. and ability to use them judiciously for the testing of given data.	**SO4.1** **SO4.2** **SO4.3** **SO4.4** **SO4.5**		**Unit 4** Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table 1.1, 1.2,1.3,1.4 1.5,1.6	As mentioned in page number ……..

PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	CO5 Apply the different sampling methods for designing and selecting a sample from a population. Compare the pairs of treatment means using different methods when null hypothesis in rejected in ANOVA.	**SO5.1** **SO5.2** **SO5.3**		**Unit 5** Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample. 1.1, 1.2,1.3,1.4 1.5,1.6	As mentioned in page number ……..

Faculty of Agriculture Science and technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Program

Course Code: **PGS502**

Course Title: **Technical writing and communication.**

Pre- requisite: Understanding the principles of various technical writing including thesis, reviews, abstracts and developing communication skills through the proper use of language.

Rationale: The basic purpose of technical writing is to convey complex information in a simple manner. It explains a topic in detail using proper abstract and citations having communication skills being accessible to a general audience.

Course Outcomes:

PGS 502.1: Learning the various form of scientific writing and implementing skills for Formulation of research based documents.

PGS 502.2: Acquisition of technical communication skill and articulate in English (verbal as writing)

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
Program Core (PCC)	PGS 502	Technical writing and communication.	0	15	2	4	21	0+1

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.
Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

ANNX-II

Proposed examination scheme (Marking) as per the recommendation of PG re-structuring ' Committee of Agricultural Education Division, Indian Council of Agricultural Research for M. Sc. Horticulture in Vegetables science 2021-22 onwards

S. No.	Category of Course/Subject	Components of Marks				Total
		Semester End Examination (External	Mid Term exam (Internal)	Assignment (Internal)	Practical Exam (Internal)	
1	Only Theory Subject Course	50	40 (20+20)	10	-	100
2	Subject/ Course with theory and Practical	50	30 (15+15)	5 (Practical Based)	15	100
3	Subject/ Course only Practical	-	-	-	100	100

Course-Curriculum Detailing:
This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

PGS 502.1: Learning the various form of scientific writing and implementing skills for Formulation of research based documents.

Approximate Hours

Item	Approximate Hours
CI	**00**
LI	**08**
SW	**01**
SL	**02**
Total	**11**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 1.1. To understand about various form writing research documents. SO 1.2. To understand about various technical writing approaches for scientific strengting of research documents. SO 1.3. To understand about editing and press reading method to avoid plagiarism.	Technical writing 1.1 Various form of scientific writing – thesis, technical papers, reviews, manuals etc. 1.2 Various part of thesis and research communication - Title page - Authorship content page - Preface - Introduction - Review of literature - Material and methods - Experimental result - Discussion 1.3 citations etc. 1.4 Commonly used abbreviations in the thesis and research communication . 1.5 Illustrations, photography and drawing with suitable captions pagination numbering of tables and illustrations. 1.6 Writing of numbers and		Enlisting and write description of research communication contents.

	dates in scientific write ups. 1.7 Editing and press reading . 1.8 Writing of review articles.		

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Various part of thesis and research communications.
- Writing of abstract, summaries, précis, citations.
- Commonly used abbreviations in the thesis and research communication .
- Write down the principal of editing and press reading.

b. Mini Project:

c. Other Activities (Specify):

PGS 502.2: Acquisition of technical communication skill and articulate in English (verbal as writing)

Approximate Hours

Item	Approximate Hours
CI	**00**
LI	**07**
SW	**01**
SL	**02**
Total	**10**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1. To understand the types, forms, tenses clauses and their uses.	Communication skill- 1.1 Grammar (Tenses, part of speed, clauses, punctuation marks) 1.2 Error analysis (common error),		Enlisting and write the description of communication using proper language skills.

SO 2.2. To understand common errors, punctuation in the sentences. SO 2.3. To understand part of speech or word class and their uses. SO 2.4. To understand discussion in groups and interviews.	concord, collocation, phonetic, symbols and transcription. 1.3 Accentual pattern: weak forms in connected speech. 1.4 Participation in group discussion 1.5 Facing of interview. 1.6 Presentation of scientific paper.		

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1 Writing types of clauses.

2 Writing the sentences using correct punctuation.

3 Writing the types and forms of tenses.

b. Mini Project:

c. Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
PGS 502.1: Learning the various form of scientific writing and implementing skills for Formulation of research based documents.	0	2	1	3
PGS 502.2: Acquisition of technical communication skill and	0	2	1	3

articulate in English (verbal as writing)				

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Technical writing**	00	05	05	10
	1.1 Various form of scientific writing – thesis, technical papers, reviews, manuals etc.	03	03	04	10
	1.2 Various part of thesis and research communication - **Title page** - **Authorship content page** - **Preface** - **Introduction** - **Review of literature** - **Material and methods** - **Experimental result** - **Discussion**	00	05	05	10
	1.3 citations etc.	03	02	05	10
	1.4 Commonly used abbreviations in the thesis and research communication .	00	00	10	10
	1.5 Illustrations, photography and drawing with suitable captions pagination numbering of tables and illustrations.	00	05	05	10
	1.6 Writing of numbers and dates in	04	02	04	10

	scientific write ups. **1.7 Editing and press reading** **1.8 Writing of review articles.**	**03**	**02**	**05**	**10**
CO 2	**Communication skill-** **1.1 Grammar (Tenses, part of speed, clauses, punctuation marks)** **1.2 Error analysis (common error), concord, collocation, phonetic, symbols and transcription.** **1.3 Accentual pattern: weak forms in connected speech.** **1.4 Participation in group discussion** **1.5 Facing of interview.** **1.6 Presentation of scientific paper.**	**03** **02** **04** **05** **00** **00**	**02** **03** **04** **02** **05** **05**	**05** **05** **00** **00** **05** **05**	**10** **10** **08** **07** **10** **10**

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for **Technical writing and communication** will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Spoken English	Barnes and Noble. Robert C. (Ed.).	Flourish Your Language	2005
2	Technical communication	Mike markel Stular A. Selber	Bedford/St. Martins, 12th edition	2017
3	The Essentials of Technical communication	Elizabeth tebeaux sam dragga.	Oxford university press,4th edition	2017
4	Technical writing prosess	Kieran morgan and sanja spajic	Better on paper publications, 1th edition	2015
5	Developing quality technical information	Moira Mcfadden lanyi, Deirdrelongo	IBM press 3th edition	2014

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Cos, POs and PSOs Mapping
Course Code:- PGS 502
Course Title: - Technical writing and communication skill.

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modernit tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprenurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				decision in various part of agriculture										
CO1- Learning the various form of scientific writing and implementing skills for Formulation of research based documents.	1	1	1	1	3	3	1	1	1	1	3	2	3	1
CO2- Acquisition of technical communication skill and	1	1	1	1	3	3	1	1	1	1	3	2	3	1

articulate in English (verbal as writing)														

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Technical writing and communication skill

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** Learning the various form of scientific writing and implementing skills for Formulation of research based documents.	**SO1.1** **SO1.2** **SO1.3**		**Unit-1**. Technical writing Various form of scientific writing – thesis, technical papers, reviews, manuals etc. Various part of thesis and research communication - Title page - Authorship content page - Preface - Introduction - Review of literature - Material and methods - Experimental result - Discussion citations etc. Commonly used abbreviations in the thesis and	As mentioned in page number ……..

				research communication . Illustrations, photography and drawing with suitable captions pagination numbering of tables and illustrations. Writing of numbers and dates in scientific write ups. Editing and press reading . Writing of review articles 1.1,1.2,1.3,1.4,`1.5,1.6,1.7,1.8,	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO2-Acquisition of technical communication skill and articulate in English (verbal as writing)			**Communication skill-** Grammar (Tenses, part of speed, clauses, punctuation marks)Error analysis (common error), concord, collocation, phonetic, symbols and transcription. Accentual pattern: weak forms in connected speech. Participation in group discussion Facing of interview. Presentation of scientific paper. 1.1,1.2,1.3,1.4,1.5,1.6.	

AKS University

Faculty of Agriculture Science and Technology

Department of Agronomy/Plant Pathology/GPB/Soil Science/Horti.

Curriculum of M.Sc.Agri Program

Course Code: **PGS 501**

Course Title : **Library and Information Services**

Pre-requisite: Student should have basic knowledge of library because course aims to familiarize the learners with the basic concept of use of library services.

Rationale: To impart to the students an understanding of knowledge classification and the theories of library classification, to develop skills in document classification and content analysis. The course provides the opportunity, ensuring freedom and equal access to information for all members of the community, to educate and enlighten them. To maintain and preserve books, materials and resources with historical, cultural, social, economic and archival value, and other related materials in an organized collection to provide members of the community these materials and enriched their personal and professional lives.

Course Outcomes:

CO1. Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.

Scheme of Studies:

Board ofStudy	Course Code	CourseTitle	Scheme of studies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	Total StudyHours(CI+LI+SW+SL)	
	PGS 501	Library and Information Services	0	1	1	1	3	1

Legend: **CI:**Class room Instructions (Includes different instructional strategies i.e. Lecture(L),Tutorial (T)and others),
LI: Laboratory Instruction(Includes Practical performance sin laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work(includes assignment, seminar, mini project etc.),

SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure out come of Learning.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks (PRA+ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+ SA+CAT+AT)		
	PGS 501	Library and Information Services							100	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion

PGS501.1: Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.

Approximate Hours

Item	Appx Hrs.
Cl	0
LI	30
SW	6
SL	3

Total	39

SessionOutcomes (SOs)	**Laboratory Instruction (LI) 1 class= 2 hrs**	**Classroom Instruction (CI)**	**(SL)**
SO1.1 Understand the Concept, Definition & Characteristics of Library **SO1.2**Understand the Importance &Functions of Library **SO1.3** Understand the Role of Library and Information Services	Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search enginesand its resources; ere sources access methods. **1.1** Introduction to library, **1.2** Types of library, **1.3** Role of library in society **1.4** Role of Education sector, **1.5** Classification scheme, **1.6** Types of Information sources **1.7** Abstracting and indexing services, **1.8** Use of Databases, OPAC **1.9** Computerized library services **1.10** Library Services **1.11** Online Public Access		1. How to Accessioning of Books on software 2 How to Books search in Library through the OPAC 3. Difference Between Library and Information Services

	Catalogue **1.12** Types of Information Centers **1.13** Library Automation **1.14** Create a Digital Library **1.15** Use of e resources		

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Introduction to library and its services;
2. Role of libraries in education, research and technology transfer,
3. Classification systems and organization of library;
4. Sources of information-, Primary Sources, Secondary Sources and Tertiary Sources;
5. Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);
6. Tracing information from reference sources;

Brief of Hours suggested for the Course Outcome

Course Outcomes	**Class lecture (CL)**	**Sessional Work (SW)**	**Self-Learning (SL)**	**Total hour (CL+SW+SL)**
Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.	30	6	3	39

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	**Unit Titles**	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	

CO1	Library and Information Services		**30**	**70**	**100**

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Library and Information Services will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

Sl. No.	Title	Author	Publisher	Edition and Year
01				
02				

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Cos, POs and PSOs Mapping
Course Code:- PGS 501
Course Title: - Library and Information Services

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in vari	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprenurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local a global agricul re and how th will affect futuris agricul re

				ous part of agriculture										
CO1- Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.	1	1	1	1	1	1	3	3	1	1	1	2	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Library and Information Services

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	CO1- Able to understand about various concepts of Library, its functions, objective and connect foundational concepts, theories, and principles of information organization and access to professional contexts.	**SO1.1** **SO1.2** **SO1.3**		**Unit-1**. Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; ere sources access methods. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12,1.13,1.14,1.15 .	As mentioned in page number ……..

AKS University

Faculty of Agriculture Science and Technology

Department of Agronomy

Curriculum of M.Sc Ag Agronomy Program

Course Code: **Agron 503**

Course Title: **Principles and practices of weed management**

Pre-requisite: Student should have basic knowledge of weed its characteristics Allelopathic effect of weed on crop. Students are acquaint with the herbicides and weed Management practices and Integrated Weed Management.

Rationale: The students should be acquainted with the knowledge of weed its importance and crop weed competition and weed ecology. Students have basic knowledge of herbicides and principles and practices of weed management practices in different cropping system. This field of study and practice is driven by several key factors and considerations: Safety, Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

Agron 503.1 Define weeds, its intensity and crop weed competition to make student expert in the weed science.

Agron 503.2 Students may acquire knowledge to herbicide classification based on Chemical, physiological mode and mechanism of action Of herbicides.

Agron 503.3 Students may acquire knowledge about herbicide structure and weed control through use of nano-herbicides and bio-herbicides, myco-herbicides and degradation of herbicide.

Agron 503.4 Student will acquaint knowledge about principles and method of weed control and management.

Agron 503.5 PG students of agronomy will become to expert in integrated weed management practices.

Scheme of Studies:

Category of course	Course Code	CourseTitle	Scheme of studies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	Total StudyHours(CI+LI +SW+SL)	
	Agro-503	Principles and practices of weed management	02	1	1	1	5	3

Legend: **CI:** Classroom Instruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)and others),
LI: Laboratory Instruction(Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteacherto ensure outcome of Learning.

Scheme of Assessment:

Theory

Category of course	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	(ESA)	(PRA+ ESA)
Program Core (SDGs)	Agro-503	Principles and practices of weed management	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agro 503.1 Define weeds, its intensity and crop weed competition to make student expert in the weed science.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the weed biology and ecology of weed and its characteristic and importance of weed. **SO1.2** Understand the crop weed competition and its effect on crop.	1. Identification of important weeds of different crops 2. Preparation of a weed herbarium	**Unit-1. Weed biology, and ecology and classification, crop-weed competition including Allelopathy; principles and methods of weed control and classification**	1. principles and methods of weed control and management and different weed indices

SO1.3 Understand the allelopathy its types and allelopathic effect of weed on crop and crop on weed. **SO1.4** Understand the principles and methods of weed control and different types of weed management practices. **SO1.5** Understand the different types of weed indices like weed control efficiency and weed index. **SO1.6** Understand the weed shift in different eco-systems .		**management; weed indices, weed shift in different eco-systems** **1.1**Introduction to Characteristics of weed and classification of weeds. **1. 2 1**Introduction to crop weed competition. **1.3** Introduction to allelopathy and its effect of weed on crop and crop on weed. **1.4** Explain the principles and methods of weed control and management **1.5** introduction to different types of weed indices. **1.6** Explain the weed shift in different eco-systems	

SW-1 Suggested Sessional Work (SW):
Assignments:

What is Weed biology and ecology. Explain classification, crop-weed competition including Allelopathy.

a. Other Activities(Specify):
Collection of weed species in AKS Campus.

Agro 503.2 Students may acquire knowledge to herbicide classification based on Chemical, physiological mode and mechanism of action Of herbicid

.

Approximate Hours

Item	AppxHrs.
Cl	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the herbicide and concept of herbicide. **SO1.2** Understand the	1. Preparation of spray solutions of herbicides	**Unit-2 Herbicides introduction and history of their development; classification based on Chemical, physiological**	1. history and development of herbicide.

development of herbicide in ancient time to modern time. **SO1.3** Understand the classification of herbicide on the basis of Chemical composition. **SO1.4**. Understand the classification of herbicide on the basis of physiological application **SO1.5** Understand the classification of herbicide on the basis of selectivity. **SO1.6** Understand the classification of herbicide on the basis of mode and mechanism of action	for high and low-volume sprayers 2. Calculation of herbicidal requirement	**application and selectivity; mode and mechanism of action Of herbicides.** **1.1** Introduction to Herbicides and its history **1.2** Introduction to Herbicides development. **1.3**. Explain the classification of herbicide on the basis of Chemical.. **1.4** Explain the classification of herbicide on the basis of physiological application **1.5** Explain the classification of herbicide on the basis of selectivity **1.6** Explain the classification of herbicide on the basis of mode and mechanism of action Of herbicide	

SW-1 Suggested Sessional Work (SW):

Assignments:

Classification based on Chemical, physiological application and selectivity mode and mechanism of action of herbicides**.**

b. Other Activities(Specify):

Agro 503.3 Students may acquire knowledge about herbicide structure and weed control through use of nano-herbicides and bio-herbicides, myco-herbicides and degradation of herbicide.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Herbicide structure factors affecting the efficiency of Herbicides. **SO1.2** Understand the herbicide formulations, herbicide mixtures, sequential application of Herbicides, and herbicide rotation . **SO1.3** Understand the use of nano-herbicides and bio-herbicides,myco-herbicides bio-agents, and allelochemicals for control the weed. **SO1.4**. Understand the movement of herbicides in soil and degradation of herbicide **SO1.5** Understand the herbicide resistance and its management. **SO1.6** Understand the herbicide combination and rotation.	1. Herbicide resistance analysis in plant and soil 2. Bioassay of herbicide resistance	**Unit-3 Herbicide structure - activity relationship; factors affecting the efficiency of Herbicides; herbicide formulations, herbicide mixtures, sequential application of Herbicides, rotation; weed control through use of nano-herbicides and bioherbicides,myco-herbicides bio-agents, and allelochemicals; movement of herbicides in soil and plant, degradation of herbicides in soil and plants; herbicide resistance, residue, persistence and management; development of herbicide resistance in weeds and crops and their management, herbicide combination and rotation.** **1.**1Introduction to Herbicide structure - activity relationship; factors affecting the efficiency of Herbicides. **1.2** Introduction to herbicide formulations, herbicide mixtures, sequential application of Herbicides, rotation . **1.3**. Introduction to weed control through use of nano-herbicides and bio-herbicides,myco-herbicides bio-agents, and allelochemicals. **1.4**. Introduction to movement of herbicides in soil and plant, degradation of herbicides in soil and plants **1.5** Introduction to herbicide resistance, residue, persistence and management**.** **1.6** Introduction to development of herbicide resistance in weeds and crops and their management,	1. Study on herbicide resistance in weeds and crops and their management, herbicide combination and rotation

		herbicide combination and rotation	

SW-1 Suggested Sessional Work (SW):

Assignments:

Movement of herbicides in soil and plant, degradation of herbicides in soil and plants herbicide resistance and its mamangement.

c. OtherActivities(Specify):

Agron 511.4 Student will acquaint knowledge about principles and method of weed control and management.

ApproximateHours

Item	AppxHrs.
Cl	06
LI	4
SW	1
SL	1
Total	12

SessionOutcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the management of Weed in major crops and cropping systems. **SO1.**2 Understand the the management of alien, invasive and parasitic weeds. **SO1.3** Understand the weed shifts in different types of cropping systems. **SO1.4**. Understand the aquatic weed control and their management. **SO1.5** Understand the perennial weed control and their management. **SO1.6** Understand the weed control	1. Weed survey in crops and cropping systems 2. Crop-weed competition studies	**Unit-4 Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennialweed control; weed control in non-crop area.** **1.1**Introduction to Weed management in major crops and cropping systems **1.2. 1**Introduction to alien, invasive and parasitic weeds and their managemen **1.3**.Introduction to weed shifts in different types of cropping systems.	1. Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management.

in non-crop area.		**1.4** Introduction to aquatic weed control and management **1.5** Introduction to perennial weed control and management. **1.6** Introduction to weed control in non-crop area.	

SW-1 Suggested Sessional Work (SW):

Assignments:

weed shifts in cropping systems; aquatic and perennial weed control; weed control in non-crop area

d. OtherActivities(Specify):

Agron 511. 5 PG students of agronomy will become to expert in integrated weed management practices.

ApproximateHours

Item	AppxHrs.
Cl	06
LI	4
SW	1
SL	1
Total	12

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Integrated weed management practice. **SO1.2** Understand the latest technology for the weed control . **SO1.3** Understand the robotics technology methods for the weed control. **SO1.4**. Understand the drones technology and aeroplane for the weed control. **SO1.5** Understand the weed	1. Use of various types of spray pumps and nozzles and calculation of swath width. 2. Economics of weed control	**Unit-5 Integrated weed management; recent development in weed management- robotics, use of drones and aeroplanes, organic etc., cost: benefit analysis of weed Management.** **1.1**Introduction to Integrated weed management practice for the management of weed. **1.2**. Introduction to latest technology for the weed control and management.	1. Study on robotics, drones and aeroplanes technology for the weed control.

control through organic methods. **SO1.6** Understand the cost: benefit analysis of weed Management. .		**1.3**.Introduction to robotics for the weed control. **1.4** Introduction to use of drones and aeroplane for the weed control. **1.5** Introduction to weed control through organic methods. **1.6** Introduction to cost: benefit analysis of weed Management.	

SW-1 Suggested Sessional Work (SW):

Assignments:

Study on latest technology for the weed control and management.

Other Activities(Specify):

Study on plant growth regulators and their role in sustainability.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lectue (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
Agro 503.1 Define weeds, its intensity and crop weed competition to make student expert in the weed science.	6	4	1	01	12
Agro 503.2 Students may acquire knowledge to herbicide classification based on Chemical, physiological mode and mechanism of action Of herbicides	6	4	1	01	12
Agro 503.3 Students may acquire knowledge about herbicide structure and weed control through use of nano-herbicides and bio-herbicides,myco-herbicides and degradation of herbicide.	6	4	1	01	12
Agro 503.4 Student will acquaint knowledge about principles and method of weed control	6	4	1	01	12

and management					
Agro 503.5 PG students of agronomy will become to expert in integrated weed management practices.	6	4	1	01	12
Total Hours	30	20	5	5	60

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Weed biology, and ecology and classification, crop-weed competition including Allelopathy; principles and methods of weed control and classification management; weed indices, weed shift in different eco-systems	03	01	01	05
CO-2	Herbicides introduction and history of their development; classification based on Chemical, physiological application and selectivity; mode and mechanism of action Of herbicides	02	06	02	10
CO-3	Herbicide structure - activity relationship; factors affecting the efficiency of Herbicides; herbicide formulations, herbicide mixtures, sequential application of Herbicides, rotation; weed control through use of nano-herbicides and bioherbicides, myco-herbicides bio-agents, and allele chemicals; movement of herbicides in soil and plant, degradation of herbicides in soil and plants; herbicide resistance, residue, persistence and management; development of herbicide resistance in weeds and crops and their management, herbicide combination and rotation.	03	07	05	15

CO-4	Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennialweed control; weed control in non-crop area	05	05	05	15
CO-5	Integrated weed management; recent development in weed management-robotics, use of drones and aeroplanes, organic etc., cost: benefit analysis of weed Management.	01	02	02	05
Total		11	26	13	50

Legend: ***R:Remember,*** ***U:Understand,*** ***A:Apply***

The end of semester assessment for principles and practices of weed management to will be held with written examination of 50 marks

Note.Detailed Assessment rubric need to be prepared by the course wise teachers for abovet asks.

Teachers can also design different task sasper requirement, for end semester assessment.

SuggestedInstructional/ImplementationStrategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to field
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook,Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming.

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Weed science: basics and applications,	das tk.	jain brothers (new delhi).	2008.
2	Recent advances in weed management.	chauhan b and mahajan g..	Springer	2014
3	Principles of weed control,	fennimore, steven a and bell, carl.	Weed sci. Soc.Grains, crc press	4th ed, 2014
4	Integrated weed management for sustainable agriculture,	zimdahl rl.	b. D. Sci. Pub.	(ed). 2018

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Cos, POs and PSOs Mapping
Course Code:-Agron- 503
Course Title: - Principles And Practices of Weed Management

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge disseminati on regarding various technique of farming and farming system in India	Wide knowle dge in the concern ing subject which will improve the farmers conditio n through student' s contribu tions.	Detailed knowled ge regardin g package and practices soil fertilizer and water manage ment of producti ve crop aspects.	Use appr opri ate scie ntifi c meth ods colla bora tion with stati stics alon g with eval uatio n whic h will prov ed to deci sion in vari ous	Detail ed knowl edge of cultiva tion practic es, soil, fertiliz ers, water manag ement and plant protec tion econo mic associ ated with farmin g enterp rises.	Create, select and apply an appropr iate techniq ues, resourc es and modern it tools in improv ement of agrono mical packag e and practic es.	Student will apply various statistic al method s to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understan d the impact of the profession al expert solutions in societal and environme ntal contexts, and demonstrat e the knowledge of, and need for sustainable developme nt in Agricultur e.	Enable to recognize and examine the relationshi ps between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprene urship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrati ve and consultancy services.	Apply researc h and experti se in resolvi ng the proble ms of existin g farm in the periphe ry of univers ities.	To understa nd and analyze the current issues that are occurrin g in local and global agricultu re and how they will affect futuristic agricultu re

				part of agriculture										
CO1- Define weeds, its intensity and crop weed competition to make student expert in the weed science.	3	3	3	3	3	1	1	1	3	3	1	2	3	1
CO2- Students may acquire knowledge to herbicide classification based on Chemical, physiological mode and mechanism of action Of herbicides	3	3	3	2	3	1	1	1	3	3	1	3	2	1
CO3- Students	3	2	1	3	2	3	1	1	3	3	2	2	1	2

may acquire knowledge about herbicide structure and weed control through use of nano-herbicides and bio-herbicides,my co-herbicides and degradation of herbicide.														
CO- 4 Student will acquaint knowledge about principles and method of weed control and management	3	2	1	3	1	3	1	1	1	3	1	3	2	1
CO5- PG students of agronnomy will become to expert in integrated	3	1	2	3	1	3	1	1	1	2	3	1	1	1

weed management practices.														

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Principles and practices of weed management

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** Define weeds, its intensity and crop weed competition to make student expert in the weed science.	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6**		**Unit-1**. Weed biology, and ecology and classification, crop-weed competition including Allelopathy; principles and methods of weed control and classification management; weed indices, weed shift in different eco-systems 1.1, 1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO2-** Students may acquire knowledge to herbicide classification based on Chemical, physiological mode and mechanism of action Of herbicides	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6**		**Unit-2** Herbicides introduction and history of their development; classification based on Chemical, physiological application and selectivity; mode and mechanism of action Of herbicides. 1.1, 1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO3-** Students may acquire knowledge about herbicide structure and weed control through use of nano-herbicides and bio-herbicides,myco-herbicides and degradation of herbicide.	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6**		**Unit-3** Herbicide structure - activity relationship; factors affecting the efficiency of Herbicides; herbicide formulations, herbicide mixtures, sequential application of Herbicides, rotation; weed control through use of nano-herbicides and bioherbicides, myco-herbicides bio-agents, and allele chemicals; movement of herbicides in soil and plant, degradation of herbicides in soil and plants; herbicide resistance, residue,	As mentioned in page number ……..

				persistence and management; development of herbicide resistance in weeds and crops and their management, herbicide combination and rotation. 1.1, 1.2,1.3,1.4,1.5,1.6	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO- 4** Student will acquaint knowledge about principles and method of weed control and management	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6**		**Unit 4**. Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennial weed control; weed control in non-crop area. 1.1, 1.2,1.3,1.4 1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5-** PG students of agronnomy will become to expert in integrated weed management practices.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6**		**Unit 5** Integrated weed management; recent development in weed management- robotics, use of drones and aeroplanes, organic etc., cost: benefit analysis of weed Management.1.1, 1.2,1.3,1.4 1.5,1.6	As mentioned in page number ……..

AKS University

Faculty of Agriculture Science and Technology
Department of Agronomy
Curriculum of M.Sc Ag Agronomy Programme

Course Code: Agron - 504 (2+1)

Course Title: Principles and practices of water management

Pre-requisite:

Students of PG need to know the basic points of water management, available water ofcrops, water need of crops, critical stages of crops for WR, soil plant water relationship its impact on crops and studies what are the role of water in crops etc.

Rationale:

This course is compulsory in agriculture because water is a life besides the utility of water for crops students need to learn water management and different practices how to applied water in crops to obtain maximum WUE.

Course Outcomes :

Agron 504.1P.G. student will become expert in water management to calculate the water use efficiency (WUE).

Agron 504.2 Acquired knowledge about water drainage system

Agron 504.3 Draw suitable figure of 90^{0} v, notch to major quantity of flowing irrigation water.

Agron 504.4 To evaluate the performance of tensiometer for determination of moisture tension in experimental field.

Agron 504.5 Acquire knowledge to differentiate irrigation methods, systems and drainage methods.

Scheme of Studies:

Category of course	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program core (SDGS)	AGRO 504	Principles and practices of water management	2	1	1	1	5	3

Legend: **CI:** Class room Instructions (Includes different instructional strategies i.e. Lecture(L),Tutorial (T)and others),

LI: Laboratory Instruction(Includes Practical performance sin laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work(includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback ofteachertoensure out come of Learning.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment**	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3)10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	
Program core (SDGS)	AGRO 504	Principles and practices of water management	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Sessional Work (SW), and Self-Learning (SL). Which students are familiar through various mode of instruction .As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agro- 504.1 PG Students has keen interest to know in details about WUE, WR and CSC

Approximate Hours

Item	Appx Hrs.
CI	5
LI	6
SW	1
SL	1
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1PG students will become a good faculty **SO1.2**Students gain knowledge about importance of water, its role in crop growth **SO1.3** Students acquired a lot of feed back after study of course **SO1.4.**They acquainted with familiar relations during the time of study	1. Determination of soil moisture percentage by gravimetric method. 2. Determination of field capacity by field method. 3. Determination of soil moisture characteristics curves.	**Unit-1.Water and its role in plants; irrigation: definition and objectives, water resources and irrigation development in India and concerned state, major irrigation projects, extent of area and crops irrigated in India and in different states.** 1.1.Water and its role in plants 1.2.Give introductory remarks in respect of role of water in crops 1.2Instruct the students about importance of irrigation in field crops. 1.3Enlist the water resources in India 1.4Give short notes on difference between catchment & command area. 1.5 Detail study of irrigation project in India and M.P.	1.Prepare a notes on water resources in India 2.study of water management systems and irrigation methods

SW-1 Suggested Sessional Work(SW):

Assignments:- Definition of irrigation given by inventor scientist with place of invention and its importance in field crops.

a. Other Activities(Specify):To determine the moisture content in soil by use of gravimetric method in field

Agro504.2 Students of PG classes will become as a expert to use irrigation system.

Approximate Hours

Item	Appx Hrs.
CI	05
LI	04
SW	01
SL	01
Total	11

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Students understand soil-water - plant relationship **SO1.2** Students gain knowledge for water absorption process by plant. **SO1.3** Students obtain knowledge about nutrient availability by crop plants. **SO1.4.**They understand hydrological cycle **SO1.5**.They have to know Scheduling of irrigation and its methods.	1. Measurement of soil moisture tension by using tensiometer. 2. Problems/ numericals to calculate N, P_2O_5 requirement of any crop through available inorganic fertilizers	Unit-II **Field water cycle, 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. Water availability and its relationship with nutrient availability and loses**. **1.1** Instruction given on hydrological cycle. **1.2** Details instruction brought to students towards soil- water-plant relationship. **1.3** Instruct about soil moisture stress condition. **1.4** To give knowledge about nutrition translocation process in crop plants **1.5** Instruct the students of PG how to increase NUE.	1.Prepare assignment in regards to soil-water-plant relationship. 2. Study made in the way of NUE.

SW-1 Suggested Sessional Work(SW):

Assignments: Prepare assignment in regards to soil-water- plant relationship with suitable figure.

b. Other Activities(Specify): Irrigation practices done by student of PG in the field crops

Agro504.3 students will become to learn all type of irrigation methods for the purpose of increasing WUE

Approximate Hours

Item	Appx Hrs.
CI	06
LI	04
SW	01
SL	01
Total	12

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 To understand the water need of crops. **SO1.2** Difference between criteria and scheduling of irrigation. **SO1.3** Micro irrigation methods **SO1.4**.Micro Plot technique method. **SO1.5** Students will aquired knowledge in relation to fertigation and herbigation.	1. Determination of field capacity and permanent wilting point by pressure plate apparatus. 2. Determination of hygroscopic coefficient.	Unit-3 **Soil, plant and meteorological factors determining water needs of crops, scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and poly houses. Irrigation efficiency and water use efficiency**. 1.1To teach which climatic factor effect the water need of crops& how. 1.2 Study of WUE. 1.3 Plant response to depth of irrigation 1.4 Study of CSC to increase crop productivity. 1.5 To acquired knowledge how drip irrigation applied in poly houses& why. 1.6 Difference between systems and methods of irrigation discussed in details.	1. Students provide practical knowledge during the time of study and they have to prepared assignment. 2. Practical calculation work for WUE.

SW-1 Suggested Sessional Work(SW):

Assignments: Assignment provide the best way of learning activity, students has been completed assignment in favour of irrigation systems & methods.

c. Other Activities(Specify):Some research work activities conducted towards water conservation practices.

Agro504.4 Students will become expert to brought his knowledge amongst the farmers after filed practices.

Approximate Hours

Item	Appx Hrs.
CI	05
LI	04
SW	01
SL	01
Total	11

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Aquired knowledge about quality of irrigation water. SO1.2 PG students gain a lot of information about CWR. SO1.3 Adoption of crop water management system for crops and cropping system. SO1.4.Gain knowledge for management of saline water. SO1.5 Studies of water management of major crop.	1.Determination of permanent wilting point by sunflower pot culture method. 2. Determination of hydraulic conductivity of saturated soil below the water table by auger hole method.	Unit-4 **Water management of crop and cropping system, quality of irrigation water and management of saline water for irrigation, water use efficiency, crop water requirement-estimation of ET and effective rainfall; water management of the major crops and cropping systems. Automated irrigation system.** 1.1 To teach the water management of crops. 1.2 Explain in details, quality of irrigation water and SWI. 1.3 To instruct about WUE with formula. 1.4 Detail study of CWR with formula. 1.5 Definition of effective rainfall & water management of corps.	1.Students learn self about CWR. 2.Students learn WUE. 3.They learn self CSC

SW-1 Suggested Sessional Work(SW):

Assignments: Assignment prepared during the study of course practical.

d. Other Activities(Specify):Practical study conducted in the field for irrigation of crops.

Agro504.5PG students will become master in water management practices and they have brought knowledge in future amongst the farmers.

Approximate Hours

Item	Appx Hrs.
CI	05
LI	02
SW	01
SL	01
Total	09

Session outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Impact of water management in problem soils. **SO1.2** Knowledge about water drainage. **SO1.3** Impact found on field drainage. **SO1.4.**To know very well about rain water management. **SO1.5.**This course study develop grand knowledge towards water management. .	1.Determination of maximum water holding capacity of soil.	**Unit-5- 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; rainwater management and its utilization for crop production**. 1.1 Give a brief notes on water management in corps 1.2 Management of problems soils explain in detail. 1.3 Instruct in detail drainage requirement of crops and its importance. 1.4 Layout of drainage channel and details on interception drainage method. 1.5 Study in brief rain water management and its utilization for corp.	1.Students aquired knowledge & prepare self learning notes for self study. 2.Students hasself notes building capacity after classroom instruction.

SW-1 Suggested Sessional Work(SW):

Assignments: Prepared assignment in details with suitable figure for different methods of drainage after field visit.

e. Other Activities(Specify): Field visit, visit in progressive farmers field & research farms.

Course Outcomes	Class Lecture (Cl)	Laboratory nstruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
Agro 504.1P.G. student will become expert in water management to calculate the water use efficiency (WUE)	05	6	01	01	13
Agro 504.2 Acquired knowledge about water drainage system	05	4	01	01	11
Agro 504.3Draw suitable figure of 90 ^{0} v, notch to major quantity of flowing irrigation water.	06	4	01	01	12
Agron504.4To evaluate the performance of tensiometer for determination of moisture tension in experimental field.	06	4	01	01	12
Agro 504.5Acquire knowledge to differentiate irrigation methods, systems and drainage methods.	05	2	01	01	9
Total Hours	27	20	05	05	57

Brief of Hours suggested for the Course Outcome

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Water and its role in plants major irrigation projects, extent of area and crops irrigated in India and in different states	07	02	02	11
CO-2	Field water cycle, water movement in soil and plantsWater availability and its relationship with nutrient availability and loses	05	02	02	09
CO-3	Soil, plant and meteorological factors determining water needs of crops, management of water in controlled environments and	07	02	02	11

	polyhouses. Irrigation efficiency and water use efficiency.				
CO-4	Water management of crop and cropping system, quality of irrigation water water management of the major crops and cropping systems. Automated irrigation system.	05	02	02	9
CO-5	Excess of soil water and plant growth; water management in problem soils, rainwater management and its utilization for crop production.	07	02	01	10
Total		31	10	09	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment Principles and practices of water management will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for abovet asks.

Teachers can also design different task sasper requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to cement plant
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming.

Suggested Learning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Irrigation water management: principles and practice.	Majumdar dk.	Phl learning Private publishers	2014
2	Irrigation: theory and practice.	michael am.	Vikas publ	1978.
3	*Principles of crop production*..	reddy sr.	Kalyani publ	2000.

Curriculum Development Team

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Cos, POs and PSOs Mapping
Course Code:-Agron- 504
Course Title: - Principles And Practices of Water Management

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge disseminati on regarding various technique of farming and farming system in India	Wide knowle dge in the concern ing subject which will improve the farmers conditio n through student' s contribu tions.	Detailed knowled ge regardin g package and practices soil fertilizer and water manage ment of producti ve crop aspects.	Use appr opri ate scie ntifi c meth ods colla bora tion with stati stics alon g with eval uatio n whic h will prov ed to deci sion in vari ous	Detail ed knowl edge of cultiva tion practic es, soil, fertiliz ers, water manag ement and plant protec tion econo mic associ ated with farmin g enterp rises.	Create, select and apply an appropr iate techniq ues, resourc es and modern it tools in improv ement of agrono mical packag e and practic es.	Student will apply various statistic al method s to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understan d the impact of the profession al expert solutions in societal and environme ntal contexts, and demonstrat e the knowledge of, and need for sustainable developme nt in Agricultur e.	Enable to recognize and examine the relationshi ps between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprene urship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrati ve and consultancy services.	Apply researc h and experti se in resolvi ng the proble ms of existin g farm in the periphe ry of univers ities.	To understa nd and analyze the current issues that are occurrin g in local and global agricultu re and how they will affect futuristic agricultu re

				part of agriculture										
CO1- P.G. student will become expert in water management to calculate the water use efficiency (WUE)	3	3	3	3	3	1	1	1	3	3	1	2	3	1
CO2- Acquired knowledge about water drainage system	3	3	3	2	3	1	1	1	3	3	1	3	2	1
CO3- Draw suitable figure of 90^0 v, notch to major quantity of flowing irrigation water.	3	2	1	3	2	3	1	1	3	3	2	2	1	2
CO4- To evaluate the	3	2	1	3	1	3	1	1	1	3	1	3	2	1

performance of tensiometer for determination of moisture tension in experimental field.														
CO5- Acquire knowledge to differentiate irrigation methods, systems and drainage methods.	3	1	2	3	1	3	1	1	1	2	3	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Principles and practices of water management

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** P.G. student will become expert in water management to calculate the water use efficiency (WUE)	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit-1**.Water and its role in plants; irrigation: definition and objectives, water resources and irrigation development in India and concerned state, major irrigation projects, extent of area and crops irrigated in India and in different states 1.1, 1.2,1.3,1.4,1.5,	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO2-** Acquired knowledge about water drainage system	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6**		**Unit-2** Field water cycle, 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. Water availability and its relationship with nutrient availability and loses 1.1, 1.2,1.3,1.4,1.5,	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO3-** Draw suitable figure of 90^0 v, notch to major quantity of flowing irrigation water.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-3** Soil, plant and meteorological factors determining water needs of crops, scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and poly houses. Irrigation efficiency and	As mentioned in page number ……..

				water use efficiency. 1.1, 1.2,1.3,1.4,1.5,1.6	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO4-** To evaluate the performance of tensiometer for determination of moisture tension in experimental field.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 4**. Water management of crop and cropping system, quality of irrigation water and management of saline water for irrigation, water use efficiency, crop water requirement- estimation of ET and effective rainfall; water management of the major crops and cropping systems. Automated irrigation system. 1.1, 1.2,1.3,1.4 1.5,	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5-** Acquire knowledge to differentiate irrigation methods, systems and drainage methods.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 5** 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; rainwater management and its utilization for crop production 1.1, 1.2,1.3,1.4 1.5,	As mentioned in page number ……..

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AKS University

Faculty of Agriculture Science and Technology

Department of Agronomy

Curriculum of M.Sc.(Ag),Department of Agronomy

Course Code: **Agron- 513**

Course Title: **Principles and Practices of Organic Farming**

Pre-requisite: Student should have basic knowledge of organic farming system, concept of sustainable agriculture. Organic farming, principles and its scope in India.

Rationale: The students should be acquainted with the knowledge of organic farming systems and patterns refer to the types and farming system. They are involved in sustainable agriculture as they to maintain soil fertility and physical condition too and to prevent pests and diseases further heal so maintaint the ecological balance, and ensure efficient use of resources such as water and nutrients. This field of study and practice is driven by several key factors and considerations: Safety, Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

Agron-513.1 Student may become expert in organic farming as well as about the organic production technology for pushing up the field through organic farming.

Agron-513.2 The knowledge gained by student through this course will be use in making decision so nnutrient dose,choice of manures and method of application etc.

Agron-513.3 Student will get to know about different processing techniques of agricultural waste products as NADED, FYM, Vermicompost etc.

Agron-513.4 Student will know different cropping and farming system like integrated farming system. To get knowledge on sustainable agricultural practices such as organic farming.

Agron- 513.5 P.G. student will able to acquaint with the modern knowledge about,certification,labelling and accreditati on procedure for organic farming.

Scheme of Studies:

Board of Study	CourseCode	CourseTitle	Schemeofstudies(Hours/Week)					TotalCredits (C)
			Cl	LI	SW	SL	TotalStudyHours (CI+LI+SW+SL)	
Program Core (SDGs)	AGRON-513	Principles and Practices of Organic Farming	3	1	1	1	6	3

Legend: **CI:**ClassroomInstruction(Includesdifferentinstructionalstrategiesi.e.Lecture(L)andTutorial (T)andothers),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworkshop,fieldorotherlocations using different instructional strategies)
SW: SessionalWork(includes assignment,seminar,miniproject etc.),
SL: SelfLearning,
C: Credits.

Note: SW & SL has to beplanned and performed underthe continuous guidance and feedback ofteacherto ensure outcome of Learnin

SchemeofAssessment:

Theory

Boardof Study	CourseCode	CourseTitle	SchemeofAssessment(Marks)							
			ProgressiveAssessment(PRA)						End Semester Assessment (ESA)	Total Marks (PRA + ESA)
			Class/ Home Assignment 5number3 marks each(CA)	ClassTest2 (2bestoutof3) 10marks each (CT)	Seminarone (SA)	ClassActivityanyone (CAT)	Class Attendance (AT)	TotalMarks (CA+CT+SA+CAT+AT)		
Program Core (SDGs)	AGRON-513	Principles and PracticesofOrganic Farming	15	20	5	5	5	50	50	100

Course-CurriculumDetailing:

This coursesy llabusillustrates the expected learning achievements,both at the course and session levels,which students are anticipatedtoaccomplish through various modes of instruction including Classroom Instruction(CI),Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AGRON-513.1 Student may be comeexpertinorganicfarmingaswellasabouttheorganicproduction technology for pushing up the field through organic farming.

ApproximateHours

Item	Appx Hrs.
Cl	5
LI	6
SW	1
SL	2
Total	14

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 UnderstandtheOrganic farming systems. **SO1.2**Understandtheprinciples and its scope of organic farming. **SO1.3** Understand the taken by Government(central/state),NGOs. **SO1.4** Understand the other Organizations for promotion of organic agriculture.	**1-**Visit of organic farms to study the various components and their utilization. **2-**Preparation of enrich compost. **3-**VC	**Unit-1.** 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, agron-forestry. **1.1** Introduction to organic farming system and its benefit. **1.2** Indices and principles and its scope of organic farming**.** **1.3** Introduction then taken by Government (central/state), NGOs. **1.3** Explain the soil and water management in cropping systems **1.4** introduction to assessment of land use. **1.5** Introduction to assessment of land use.	**1.**Organic farming system and know the importance of cropping system and management of resources. **2.** The assessment of land use according to the crop.

SW-1SuggestedSessionalWork(SW):

Assignments:

What is Organic farming systems?definition ,indices and its importance and physical resources and its managemen

a. Other Activities(Specify):

Research on most suitable organic farming systems for the Satna Region.

AGRON-513.2 P.G. student will able to acquaint with the modern knowledge about, certification, labelling and accreditation procedure for organic farming.

Approximate Hours

Item	AppxHrs.
Cl	06
LI	8
SW	2
SL	1
Total	17

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 UnderstandtheConceptof sustainability in organic farming systems and farming systems. **SO1.2** Understand the Organic farming and water use efficiency and farming systems **SO1.3** Understand the nutrient recycling, organic residues, organic manures,composting,soil biota. **SO1.4**. Understand green manures,bio-fertilizersand biogas technology**.**	**1-** efficient use of biofertilizers, technique of treating legume seeds with *rhizobium.* ***2-*** Cultures, use of *azotobacter*, *azospirillum*, and psb cultures in field.	**Unit-2 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.** **1.1** Introduction to Concept of sustainability intercropping systems and farming systems. **1.2** The nutrient recycling, organic residues, organic manures, composting, soil biota.	1.Concept of organic farming systems and farming systems. in Satna region.

SO1.5 Understand the decomposition of organic residues, earth worms and vermicompost.	**3-** visit to a bio gas plant **4-** visit to an organic farm	**1.3**.production potential under Organic nutrient resources. **1.4** production potential green manures,bio-fertilizers and biogas technology**.** **1.5 P**roduction potential under fortification. 1.6 The decomposition of organic residues, earthworms and vermicompost.	

SW-1SuggestedSessionalWork(SW):

Assignments:

Concept of sustainability intercropping systems and farming systems, scope and Objectives production potential under different cropping system.

b. OtherActivities(Specify):

Research on most suitable organic farming for the Satna Region.

AGRON-513.3 Students will know different cropping and farming system like integrated farming system. To get knowledge on sustainable agricultural practices such as organic farming.

ApproximateHours

Item	Appx Hrs.
Cl	06
LI	4
SW	1
SL	1
Total	12

SessionOutcomes (SOs)	Laboratory Instruction (LI)	ClassroomInstruction (CI)	Self-Learning (SL)
SO1.1 Understand the Choice of crops and varieties in organic farming. **SO1.2**Understand the allelopathic effects of weed on crop, weed on crop and crop on weed. **SO1.3**Understand the multiple and relay cropping systems. **SO1.4**.Understand the role of intercropping in relation to maintenance of soil. **SO1.5**Understand the research need on sustainable agriculture	**1-** Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management. **2-**Cost of organic production system.	Unit-3 Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity. **1.1** Introduction to Choice of crops and varieties in organic farming. **1.2** Introduction to allelopathic and its effects on crop. **1.3** Introduction to the multiple and relay cropping systems. **1.4** Multi-storied cropping and yield stability in intercropping **1.5** Role of disease and weed management under organic mode of production**.** **1.6** New research need on sustainable agriculture and new innovation on sustainable agriculture.	1.Study of insect, pest, disease and weed management under organic mode of production in Sustainable agriculture.

SW-1SuggestedSessionalWork(SW):

Assignments:

Role of non-monetary Inputs and low cost technologies; research need on sustainable agriculture

c. OtherActivities(Specify):

New Research on sustainable agriculture.

AGRON-513.4 Studentwillgettoknowaboutdifferentprocessingtechniquesofagriculturalwaste products as NADED, FYM, Vermicompost etc

ApproximateHours

Item	AppxHrs.
Cl	04
LI	4
SW	1
SL	1
Total	10

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand Control of weeds, diseases and insect pest management. **SO1.**2 Understand the organic farming and role for organic farming to maintain soil Fertility. **SO1.3**Understand the biological agents and pheromones, bio- pesticides. **SO1.4**.Understand the fertilizer Use in intensive organic farming system. **SO1.5**Understand the advanced nutritional tools for big data analysis and interpretation.	**1-** Cost of organic production system. **2-** Post harvest management.	Unit-4 Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides. **1.1**Introducing to Control of weeds, diseases and insect pest management. **1.2** organic farming and role of organic farming to maintain soil Fertility. **1.3** The biological agents and pheromones, bio-pesticides. **1.4**Introduction to management of crop residue and nutrient use efficiency.	1. Study on crop diversification and importance of organic farming for the sustainable agriculture.

SW-1SuggestedSessionalWork(SW):

Assignments:

d. Operational Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides of organic farming.

OtherActivities(Specify):
Research on weeds, diseases and insect pest management.

AGRON-513.5 Theknowledgegainedbystudentthroughthiscoursewillbeusefulin making decisions on nutrient dose, choice of manures and method of application etc.

ApproximateHours

Item	AppxHrs.
Cl	04
LI	4
SW	1
SL	1
Total	10

SessionOutcomes (SOs)	**Laboratory Instruction (LI)**	**ClassroomInstruction (CI)**	**Self-Learning (SL)**
SO1.1 UnderstandtheProcessingof organic farming. **SO1.2**Understandthelevelingof organic farming. **SO1.3**Understandthemarketingand export of organic farming. **SO1.4**. Understand the economic considerations and viability, marketing of organic products.	**1**- quality standards, inspection, certification and labeling and accreditation. **2**-Procedures for farm produce from organic farms.	Unit-5 Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides. **1.1**Introduction to Processing of organic farming. **1.2**.Introduction the leveling of organic farming. **1.3**Introduction marketing and export of organic farming. **1.4**Introduction to the economic considerations and viability, marketing of organic products.	1. Study on Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

SW-1SuggestedSessionalWork(SW):

Assignments: Processing,leveling,economic considerations and viability, marketing and export potential of organic products

e. OtherActivities(Specify):

Study on Processing, leveling, economic considerations and viability, marketing and export of organic materials.

Brief of Hours suggested for the Course Outcome

CourseOutcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (Sl)	Totalhour (Cl+SW+Sl)
AGRON- 513.1 Student may become expert in organic farming as well as about the organic production technology for pushing up the field through organic farming.	5	**6**	1	2	14
AGRON- 513.2 The knowledge gained by student through this course will be useful in making decisions on nutrient dose, choice of manures and method of application etc.	6	**8**	2	1	17
AGRON-513.3Studentwillgettoknowaboutdifferent processing techniques of agricultural waste products as NADED, FYM, Vermicompost etc.	6	4	1	1	12
AGRON- 513.4 Student will know different cropping and farming system like integrated farming system. To get knowledge on sustainable agricultural practices such As organic farming.	4	4	1	1	10
AGRON- 513.5 P.G. student will able to acquaint with the modern knowledge about, certification, labelling and accreditation procedure for organic farming.	4	**4**	1	1	10
Total Hours	25	**26**	6	6	63

SuggestionforEndSemesterAssessment

CO	UnitTitles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Unit-1. 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, agron-forestry.	03	01	01	05
CO-2	Unit-2 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 bio gas technology.	02	06	02	10
CO-3	Unit-3Farming systems,selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.	03	07	05	15
CO-4	Unit-4Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.	-	10	05	15
CO-5	Unit-5 Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures ;organic farming and national economy.	03	02	-	05
Total		11	26	13	50

Legend: R:Remember, U:Understand, A:Apply

TheendofsemesterassessmentforIntroductiontoprinciplesandpracticesof organicfarming willbeheld with written examination of 50 marks

Note.DetailedAssessmentrubricneedtobepreparedbythecoursewiseteachersforabove tasks.Teacherscanalso designdifferent tasks asperrequirement, forendsemesterassessment.

SuggestedInstructional/ImplementationStrategies:

1. ImprovedLecture
2. Tutorial
3. CaseMethod
4. GroupDiscussion
5. Visittofarm/ field
6. Demonstration

SuggestedLearning Resources:

(a)Books:

S. No.	Title	Author	Publisher	Edition& Year
1	Organic farming	Lampinn	lpswitch,uk	1990
2	Organic farming–theory and practice.	Palaniappansp &ananduraik.		1999
3	Hand book of organic farming	SharmaA	Agronbios	2002
4	Soil microbiology	Subbaraons	Oxford&ibh.	2002
5	A text book of environmental sciences	Trivedirn.	anmolpubl.	1993
6	Organic farming and sustainable agriculture.	Veereshgk, shivashankar k&suiglacharma.		1997

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Cos, POs and PSOs Mapping
Course Code:-Agron- 513
Course Title: - Principles and Practices of Organic Farming

Course Outcomes	**Program Outcomes**									**Program Specific Outcome**				
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepren	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				to decision in various part of agriculture	.					eurship.				
Co1 - Student may become expert in organic farming as well as about the organic production technology for pushing up the field through organic farming.	3	3	3	3	3	2	1	1	3	3	1	2	3	2
Co2 -The knowledge gained by student throughthiscoursewillbeusefulinmaking	3	3	3	2	3	1	1	1	3	3	1	3	2	2

decisions on nutrient dose, choice of manures and method of application etc.														
Co3 - Studentwillgettoknowaboutdifferent processing techniques of agricultural waste products as NADED, FYM, Vermicompost etc.	2	2	2	3	2	3	1	1	3	3	2	2	1	2
Co4 Student will know different cropping and	3	2	1	3	1	3	1	1	1	3	1	3	2	1

farming system like integrated farming system. To get knowledge onsustainableagriculturalpracticessuch asorganic farming.														
Co5 -P.G. student will able to acquaint with themodernknowledgeabout,certification,labellingand accreditation procedure for organic farming.	3	1	2	3	1	3	1	1	1	2	3	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Principles and Practices of Organic Farming

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**Co1 -** Student may become expert in organic farming as well as about the organic production technology for pushing up the field through organic farming.	**SO1.1 SO1.2 SO1.3 SO1.4**		**Unit-1**. 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, agron-forestry. 1.1, 1.2,1.3,1.4.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**Co2 -**The knowledge gained by student through this course will be use ful in making decision nutrient dose, choice of manures and method of application etc.	**SO1.1 SO1.2 SO1.3 SO1.4 SO1.5**		**Unit-2** 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	As mentioned in page number ……..

				and biogas technology. 1.1, 1.2,1.3,1.4,1.5.	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**Co3** –Student will get to know about different processing techniques of agricultural waste products as NADED, FYM, Vermicompost etc.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-3** Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity. 1.1, 1.2,1.3,1.4,1.5,	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**Co4** Student will know different cropping and farming system like integrated farming system. To get knowledge on sustainable agricultural practices such As organic farming.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 4**. Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides. 1.1, 1.2,1.3,1.4 1.5.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**Co5** -P.G. student will able to acquaint with the modern knowledge about, certification, labeling and accreditation procedure for organic farming.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit 5** Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides. 1.1, 1.2,1.3,1.4 .	As mentioned in page number ……..

AKS University

Faculty of Agriculture Science and technology

Department of Agronomy

Curriculum of M.Sc Ag Agronomy Program

Course Code: **Agron 512**

Course Title: **Dry land farming and watershed management (2+1)**

Pre-requisite: Student should have specific knowledge of crops, Dry land farming and watershed management

Rationale: The students should be acquainted with the knowledge of Crops and patterns refer to the types and sequences of crops that are grown. They are involve in sustainable agriculture as they to maintain soil fertility and physical condition too and to prevent pests and diseases further the also maintain the ecological balance, and ensure efficient use of resources such as water and nutrients. This field of study and practice is driven by several key factors and considerations: Safety, Sustainability, Innovation and technology, Economic efficiency.

Course Outcomes:

Agron 512.1. Students will become to define dryland farming and its constraints.

Agron 512.2 students will become to differentiate dryland farming and rainfed farming.

Agron 512.3. Pg students acquainting knowledge to calculate catchment and command area.

Agron 512.4 students of pg able to evaluate concept of conservation of tillage.

Agron 512.5. Students will become as expert to design water harvesting tank under the watershed management technology.

Scheme of Studies:

Category of course	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core (SDGs)	Agron 512	Dry land farming and watershed management	2	0	1	1	4	2

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e .Lecture (L)and Tutorial (T)and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory work shop, field or other locations using different instructional strategies)
SW: Sessional Work(includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Couse Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment	Total Marks
			Class/Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)	**(ESA)**	(PRA+ ESA)
Program Core (SDGs)	Agron 512	Dry land farming and watershed management	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agron 512.1. Students will become to define dryland farming and its constraints.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	06
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Students will become to define dryland farming **SO1.1** Dryland farming Constraints.	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	**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. **1.1** Definition, concept **1.2** characteristics of dry land farming; **1.3** dry land versus rainfed farming; **1.4** significance **1.5** dimensions of dry land farming **1.6** dimensions of dry land farming in indian agriculture.	1. Definition, concept characteristics of dry land farming

SW-1 Suggested Sessional Work (SW):

Assignments:

What is Cropping systems? definition, indices and its importance and physical resources and its management in cropping system.

a. OtherActivities(Specify):

Research on most suitable Cropping systems for the Satna Region.

Agron 512.2 students will become to differentiate dryland farming and rainfed farming.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	06
SW	1
SL	1
Total	14

Session Outcomes	Laboratory	Classroom Instruction	Self-

(SOs)	Instruction (LI)	(CI)	Learning (SL)
SO1.1 students will become to differentiate dryland farming **SO1.2** students will become to differentiate rainfed farming.	1.Moisture stress effects and recovery behaviour of important crops 2. estimation of potential et by thornthwaite method 3. estimation of reference et ny penman monteith method	**Unit ii** Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; typesof drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions. 1.1Soil and climatic parameters 1.2 special emphasis on rainfall 1.3characteristics; constraints limiting 1.4crop production in dry land areas; typesof drought, 1,5characterization of environment for water availability; 1.6crop planning for erratic and aberrant weather conditions.	1. crop production in dry land areas; typesof drought,

SW-1 Suggested Sessional Work (SW):

Assignments:

Concept of sustainability in cropping systems and farming systems, scope and Objectives production potential under different cropping system.

b. OtherActivities(Specify):

Research on most suitable intercropping for the Satna Region.

Agron 512.3. Pg students acquainting knowledge of canal lateral alignment and command area.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	06
SW	1
SL	1
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 students acquainting knowledge to calculate catchment **SO1.2** students acquainting knowledge to calculate command area.	1.Classification of climate by thornthwaite method (based on moisture index, Humidity index and aridity index) 2.Classification of climate by koppen method 3. Estimation of water balance by thornthwaite method	**Unit iii-** Stress physiology and resistance to drought, adaptation of crop plants todrought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather Conditions. **3.1** Stress physiology **3.2** Resistance todrought, **3.3** Adaptation of crop plants to drought, **3.4** Drought management strategies; **3.5** Preparation of appropriate cropplans for dry land areas; **3.6** Mid contingent plan for aberrant weather Conditions.	**1** adaptation of crop plants todrought,

SW-1 Suggested Sessional Work (SW):

Assignments:

Role of non-monetary Inputs and low cost technologies; research need on sustainable agriculture

c. Other Activities(Specify):

New Research on sustainable agriculture.

Agron 512.4 students of pg able to evaluate concept of conservation of tillage.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	06
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 students of pg able to evaluate concept of tillage. **SO1.2** students of pg able to evaluate concept of conservation of tillage.	1. assessment of drought 2.estimation of length of growing period 3. estimation of probability of rain and crop planning for different drought condition	**Unit iv-** Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use. **4.1** Tillage, tilth, **4.2** frequency and depth of cultivation, 4.3 compaction in soil tillage; 4.4 concept of conservation tillage; **4.5** tillage in relation to weed control and moisture conservation; **4.6** techniques andpractices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use.	1. Tillage in relation to weed control and moisture conservation.

SW-1 Suggested Sessional Work (SW):

Assignments:

Crop diversification for sustainability; role of organic matter in maintenance of soil Fertility; crop residue management; fertilizer use efficiency

d. OtherActivities(Specify):

Research on nutrient use efficiency. .

Agron 512.5. Students will become as expert to design water harvesting tank under the watershed management technology.

Approximate Hours

Item	Appx Hrs.
Cl	06
LI	06
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Students will become as expert to design water harvesting tank under the **SO1.2**Students will become as expert to watershed management technology.	1.spray of anti-transpirants and their effect on crops 2.water use efficiency 3. Visit to dryland research stations and watershed projects	**Unit v-** Concept of watershed resource management, problems, approach and components. **5.1** Concept of watershed **5.2** Resource of watershed **5.3** Management of watershed **5.4** Problems of watershed **5.5** Approach of watershed **5.6** Components of watershed	1. resource of watershed management, of watershed 2.problems, of watershed

SW-1 Suggested Sessional Work (SW):

Assignments:

Crop diversification for sustainability; role of organic matter in maintenance of soil Fertility; crop residue management; fertilizer use efficiency

e. OtherActivities(Specify):

Research on nutrient use efficiency. .

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self Learning (Sl)	Total hour (Cl+SW+ Sl)
Agron 512.1. Students will become to define dryland farming and its constraints.	6	6	1	14
Agron 512.2 students will become to differentiate dryland farming and rainfed farming.	6	6	1	14
Agron 512.3. Pg students acquainting knowledge to calculate catchment and command area.	6	6	1	14
Agron 512.4 students of pg able to evaluate concept of conservation of tillage.	6	6	1	14
Agron 512.5. Students will become as expert to design water harvesting tank under the watershed management technology.	6	6	1	14
Total Hours	30	30	5	70

Suggestion for End Semester Assessment

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	**Unit i** – Definition, concept and characteristics of dry land farming; dry land versusrainfed farming; significance and dimensions of dry land farming in indian agriculture.	03	01	01	05
CO-2	**Unit ii** Soil and climatic parameters with special emphasis on rainfallcharacteristics; constraints limiting crop production in dry land areas; typesof drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.	02	06	02	10
CO-3	**Unit iii-** Stress physiology and resistance to drought, adaptation of crop plants todrought, drought management strategies; preparation of appropriate cropplans for dry land areas; mid contingent plan for aberrant weather Conditions.	03	07	05	15
CO-4	**Unit iv-** Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques andpractices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use.	-	10	05	15
CO-5	**Unit v-** Concept of watershed resource management, problems, approach andcomponents.	03	02	-	05
Total		11	26	13	50

Legend: R: Remember, U: Understand A: Apply

The end of semester assessment for Introduction to principles and practices of organic farming will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for abovetasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Visit to farm/ field
6. Demonstration

Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Tillage and crop production.	Das nr..	Scientific publishers.	2007
2	Agron technology for dryland farming.	Dhopte am.	Scientific publ.	2002.
3	Soil and water conservation research in india.	Dhruv narayan vv.	Icar.	2002.
4	Production and improvements of crops for drylands.	Gupta us. (ed.)..	Oxford & ibh.	1995

Curriculum Development Team

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2. Dr. V. D. Dwivedi, Professor, Dept. of Agronomy, FAST
3. Dr. H. S. Kushwah, Professor, Dept. of Agronomy, MGCGVV
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5. Dr. P. K. Bagri, Assistant Professor, Dept. of Agronomy, FAST
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Cos, POs and PSOs Mapping
Course Code:-Agron- 512
Course Title: - Dry land farming and watershed management

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				of agriculture										
CO1- Students will become to define dry land farming and its constraints.	3	3	3	1	3	1	1	1	3	3	1	2	3	1
CO2- students will become to differentiate dry land farming and rainfed farming.	3	3	3	1	3	1	1	1	3	3	1	3	2	1
CO3- Pg students acquainting knowledge to calculate catchment and command area.	3	2	3	1	2	3	1	1	3	3	2	2	1	2
CO4- students of pg able to evaluate concept of	3	2	1	1	1	3	1	1	1	3	1	3	2	1

conservation of tillage.														
CO5-. Students will become as expert to design water harvesting tank under the watershed management technology.	3	1	2	1	1	3	1	1	1	2	3	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Dry land farming and watershed management

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** Students will become to define dry land farming and its constraints.	**SO1.1** **SO1.2**		**Unit-1**. Definition,concept and characteristics of dryland farming;dryland versus rainfed farming; significance and dimensions of dry land farming in indian agriculture 1.1, 1.2,1.3,1.4,1.5,1.6,	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO2-** students will become to differentiate dry land farming and rainfed farming.	**SO1.1** **SO1.2**		**Unit-2** Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; typesof drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions. 1.1, 1.2,1.3,1.4,1.5,1.6	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO3-** Pg students acquainting knowledge to calculate catchment and command area.	**SO1.1** **SO1.2**		**Unit-3** 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 1.1, 1.2,1.3,1.4,1.5,1.6	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO4-** students of pg able to evaluate concept of conservation of tillage.	**SO1.1** **SO1.2**		**Unit-4** Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and	

				practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use. 1.1, 1.2,1.3,1.4,1.5,1.6	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO5-**. Students will become as expert to design water harvesting tank under the watershed management technology.	**SO1.1** **SO1.2**		**Unit-5** Concept of watershed resource management, problems, approach and components. 1.1, 1.2,1.3,1.4,1.5,1.6	

AKS University

Faculty of Agriculture Science and technology

Department of Agronomy

Curriculum of M.Sc.(Ag) Agronomy Program

Course Code: **APP 501**

Course Title: **Principles of plant physiology**

Pre-requisite: Student should have knowledge of plant physiology Core concepts in plant physiology, with specific focus on photosynthesis, respiration, water relations, mineral nutrition, growth and allocation, hormones, secondary metabolites, reproduction, and stress physiology.

Rationale: The students should be acquainted with the knowledge of Plant physiology it is a disc botany concerned with physiological processes and activities of plants. It's a descript of variation and structure at the molecular and cellular level that leads to investigatio ecological, physiological, and biochemistry-related elements of plants. Plant physiolc study of all of a plant's internal functions, including the chemical and physical mecha are connected with life in plants. This encompasses research at many scales of size ar Photosynthesis, molecular interactions and internal diffusion of water, minerals, and r are at the molecular level. Plant development, seasonality, dormancy, and reproductiv are all activities that take place on a large scale. Phytochemistry and phytopathology major subfields of plant physiology. Plant physiology is the initial line of defence anc primary means of interaction with the environment and climate.

Course Outcomes:

App 501.1PG students will familiar with the knowledge of plant physiology.

App 501.2 Students will able to acquaints knowledge about anti transparent to check the loss of water.

App 501.3 Students will become expert to calculate the daily plant growth by recording the growth data taken by auxanometer.

App 501.4 Students will able to acquaint knowledge to distinguish between osmosis and diffusion process.

App 501.5PG students will become expert in soil plant water relationship.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+SW+SL)	
Program Core (SDGs	APP-501	Principles of plant physiology	3	1	1	1	6	3

Legend: **CI:** Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others,

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

SW: Sessional Work (includes assignment, seminar, mini project etc.),

SL: Self learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA + ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	Class Test 2 (2 best out of 3) 10 marks each (CT)	Seminar one (SA)	Class Activity any one (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
Program Core (SDGs)	APP-501	Principles of plant physiology	15	20	5	5	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

App 501.1 PG students will familiar with the knowledge of plant physiology.

Approximate Hours

Item	Appx Hrs.
Cl	6
LI	4
SW	1
SL	2
Total	13

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Understand the Water and its importance, molecular structure of water **SO1.2**Understand the Concept of water potential. **SO1.3** Understand the concept of osmosis and diffusion. **SO1.4** Understand the Soil physical properties and water availability in different soils. **SO1.5** Understand the WHC and PWP	1. Standard solutions and preparation of different forms of solutions 2. Studies on the basic properties of water	**Unit 1: soil and plant water relations** Water and its importance; molecular structure of water; properties and functions of water. Concept of water potential; plant cell and soil water potential and their components; methods to determine cell and soil water potential; concept of osmosis and diffusion. Soil physical properties and water availability in different soils; water holding capacity and approaches to improve WHC; concept of FC and PWP; Water holding polymers and their relevance. **1.1**Introduction toWater and its importance. **1.2** Molecular structure of water; properties and functions of water. **1.3**Introduction to concept of water potential. **1.4**Explain theconcept of osmosis and diffusion. **1.5** Explain the soil physical properties and water availability in different soils. **1.6** Explain the WHC, FC and PWP	1. methods to determine cell and soil water potential 2. Studies on WHC, FC and PWP.

SW-1 Suggested Sessional Work (SW):
Assignments:

What is the concept of water potential?
OtherActivities(Specify):

Research on study soil WHC, FC and PWP.

App 501.2 students will able to acquaints knowledge about anti transparent to check the loss of water.

Approximate Hours

Item	AppxHrs.
Cl	5
LI	6
SW	1
SL	1
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Root structure and functions**.** **SO1.2**Understand the root architecture and relevance in water mining. **SO1.3**Understand the mechanism of water absorption and translocation**.** **SO1.4**. Understand the mycorrhizal association and its relevance in water mining.	1.Demonstration of surface tension of water and other solvents. 2.Measurement of plant water status: relative water content and rate of water loss. 3.Determination of water potential through tissue volume and chardakov's test	**Unit 2: water absorption and translocation** Root structure and functions; root architecture and relevance in water mining; mechanism of water absorption and translocation; theories explaining water absorption and trans location;aquaporins. Mycorrhizal association and its relevance in water mining. **1.1**Introduction to Root structure and functions. **1.2**Introduction toroot architecture and relevance in water mining. **1.3**.Introduction tomechanism of water absorption and translocation. **1.4**Explain thetheories explaining water absorption and translocation. **1.5** Introduction to aquaporins. Mycorrhizal association and its relevance in water mining.	1.Concept of root structure and function of plant.

SW-1 Suggested Sessional Work (SW):

Assignments:

Concept in Root structure and functions; root architecture and relevance in water mining; mechanism of water absorption and translocation; theories explaining water absorption and translocation**.**

Other Activities (Specify):

Research on study Mycorrhizal association and its relevance in water mining.
App 501.3students will become expert to calculate the daily plant growth by recording the growth data taken by auxanometer.

Approximate Hours

Item	Appx Hrs.
Cl	6
LI	4
SW	1
SL	1
Total	12

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Evaporation and transpiration. **SO1.2** Understand the concept of CCATD and its relevance. **SO1.3** Understand the Energy balance: solar energy input and output at crop canopy level. **SO1.4.** Understand the Stomata- its structure, functions and distribution; molecular mechanisms of stomatal opening and closing **SO1.5** Understand the concept of Guard cell turgidity; role of k and other osmolytes; role of aba in stomatal closure; guard cells response to environmental signals; signaling cascade associated with stomatal opening and closure. **SO1.6**Understand the concept of Anti transparent and their relevance in agriculture.	1.Determination of water potential using pressure bomb, osmometer, psychrometer 2.Determination of soil moisture content and soil water potential	**Unit 3: transpiration and evaporative cooling** Evaporation and transpiration; relevance of transpiration; factors regulating transpiration; measurement of transpiration; approaches to minimize evaporation and transpiration; concept of CCATD and its relevance. Energy balance: solar energy input and output at crop canopy level. Stomata- its structure, functions and distribution; molecular mechanisms of stomata opening and closing; concept of Guard cell turgidity; role of k and other osmolytes; role of aba in stomatal closure; guard cells response to environmental signals; signaling cascade associated with stomatal opening and closure. Anti transparent and their relevance in agriculture. **1.1** Introduction to Evaporation and transpiration. **1.2** Introduction to concept of CCATD and its relevance. **1.3**.Introduction toEnergy balance: solar energy input and output at crop canopy level. **1.4**. Introduction toStomata- its structure, functions and distribution; molecular mechanisms of stomatal opening and closing **1.5.** Introduction totheconcept of Guard cell turgidity; role of k and other osmolytes; role of aba in stomatal closure; guard cells response to environmental signals; signaling cascade associated with stomatal opening and closure. **1.6**.Introduction toconcept of Anti transpirant sand their	1. Study on Evaporation and transpiration in details.

		relevance in agriculture.	

SW-1 Suggested Sessional Work (SW):

Assignments:

Role of Antitranspirants and their relevance in agriculture.

a. Other Activities(Specify):

New Research on role of physiology in agriculture.

App 501.4 students will able to acquaint knowledge to distinguish between osmosis and diffusion process.

Approximate Hours

Item	AppxHrs.
Cl	5
LI	6
SW	1
SL	1
Total	13

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the WUE and its relevance in water productivity. **SO1.2**Understand the transpiration efficiency, a measure of intrinsic WUE. **SO1.3** Understand the approaches to measure WUE. **SO1.4**. Understand the stomatal and mesophyll regulation on WUE. **SO1.5**Understand the passioura's yield model emphasizing WUE.	1. Use of soil moisture probes and soil moisture sensors 2.Measurement of transpiration rate in plants; use of porometry. 3.Measurement of CCATD and its relevance.	**Unit 4: water productivity and water use efficiency** WUE and its relevance in water productivity; transpiration efficiency, a measure of intrinsic WUE; approaches to measure WUE; stomatal and mesophyll regulation on WUE; passioura's yield model emphasizing WUE. **1.1**Introduction to WUE and its relevance in water productivity. **1.2**.Introduction tothe transpiration efficiency, a measure of intrinsic WUE. **1.3**.Introduction tothe approaches to measure WUE. **1.4** Introduction the stomatal and mesophyll regulation on WUE. **1.5**Introduction topassioura's yield model emphasizing WUE.	1. Study on WUE of different crop.

SW-1 Suggested Sessional Work (SW):

Assignments:

Crop diversification for sustainability; role of WUE in maintenance of soil Moisture.

Other Activities(Specify):

Research on WUE.

App 501.5PG students will become expert in soil plant water relationship.

Approximate Hours

Item	AppxHrs.
Cl	6
LI	6
SW	1
SL	1
Total	14

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Understand the Physiology of water stress in plants. **SO1.2**Understand the effect of moisture stress. **SO1.3** Understand the cellular organ and plant level. **SO1.4**. Understand the Drought indices. **SO1.5**. Understand the Drought tolerance. **SO1.6**. Understand the Drought tolerance traits.	1. Demonstration and use of anti-transpirants to reduce transpiration. 2. Influence of potassium and aba on stomatal opening and closing respectively 3.Deficiency and toxicity symptoms of nutrients	**Unit 5: moisture stress and plant growth** Physiology of water stress in plants; effect of moisture stress at molecular, cellular organ and plant level. Drought indices and drought tolerance strategies. Drought tolerance traits. **1.1**Introduction the Physiology of water stress in plants. **1.2.1**Introduction to Understand the effect of moisture stress. **1.3**.Introduction tothe cellular organ and plant level. **1.4.** Introduction to the Drought indices. **1.5**.Introduction to the Drought tolerance. **1.6** Introduction tothe Drought tolerance traits.	1.Study on Physiology of water stress in plants.

SW-1 Suggested Sessional Work (SW):

Assignments:

Understand the Physiology of water stress in plants.

b. Other Activities(Specify):

Study on Drought tolerance traits.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Laboratory Instruction (LI)	Sessional Work (SW)	Self Learning (SL)	Total hour (Cl+LI+SW+Sl)
App 501.1pg students will familiar with the knowledge of plant physiology.	6	**4**	1	2	13
App 501.2 students will able to acquaints knowledge about antitranspirant to check the loss of water.	5	**6**	1	1	13
App 501.3students will become expert to calculate the daily plant growth by recording the growth data taken by auxanometer.	6	4	1	1	12
App 501.4 students will able to acquaint knowledge to distinguish between osmosis and diffusion process.	5	6	1	1	13
App 501.5PG students will become expert in soil plant water relationship.	6	**6**	1	1	14
Total Hours	28	**26**	5	6	65

Suggestion for End Semester Assessment

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO-1	Unit 1: soil and plant water relations Water and its importance; molecular structure of water; properties and functions of water. Concept of water potential; plant cell and soil water potential and their components; methods to determine cell and soil water potential; concept of osmosis and diffusion. Soil physical properties and water availability in different soils; water holding capacity and approaches to improve WHC; concept of FC and PWP; Water holding polymers and their relevance.	03	01	01	05
CO-2	Unit 2: water absorption and translocation Root structure and functions; root architecture and relevance in water mining; mechanism of water absorption and translocation; theories explaining water absorption and translocation; aquaporins. Mycorrhizal association and its relevance in water mining.	02	06	02	10
CO-3	Unit 3: transpiration and evaporative cooling Evaporation and transpiration; relevance of transpiration; factors regulating transpiration; measurement of transpiration; approaches to minimize evaporation and transpiration; concept of CCATD and its relevance. Energy balance: solar energy input and output at crop canopy level. Stomata- its structure, functions and distribution; molecular mechanisms of stomatal opening and closing; concept of Guard cell turgidity; role of k and other osmolytes; role of aba in stomatal closure; guard cells response to environmental signals; signaling cascade associated with stomatal opening and closure. Antitranspirants and their relevance in agriculture.	03	07	05	15
CO-4	Unit 4: water productivity and water use efficiency WUE and its relevance in water productivity; transpiration efficiency, a measure of intrinsic WUE; approaches to measure WUE; stomatal and mesophyll regulation on WUE; passioura's yield model emphasizing WUE.	-	10	05	15

CO-5	Unit 5: moisture stress and plant growth Physiology of water stress in plants; effect of moisture stress at molecular, cellular organ and plant level. Drought indices and drought tolerance strategies. Drought tolerance traits.	03	02	-	05
Total		11	26	13	50

Legend: R:Remember, U:Understand, A:Apply

The end of semester assessment for Principles and practices of soil fertility and nutrients management will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visitto field
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition &Year
1	Plant Physiology	Bhatia KN & Prashar AN.	Truman Book Company.	1990
2	Plant Physiology	Salisbury FB. & Ross CW	Wordsworth Publishing Company.	1992
3	Plant Physiology	F. B. and Ross,C. W.	Thomson Asia Ptd, Ltd. Singapore.	2004
4	Physicochemical and Environmental Plant Physiology.	Nobel P. S.	Elsevier Academic Press, Amsterdam Salisbury,	2005
5	Physiological Plant Ecology: Ecophysiology and Stress Physiology of Functional Groups	Larcher, W.	Springer Science & Business Media	2003

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9. Mis. Prachi Awadhiya, Teaching Associate, Dept. of Agronomy, FAST

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Cos, POs and PSOs Mapping

Course Code:- APP 501

Course Title: - Principles of plant physiology

Course Outcomes	**Program Outcomes**									**Program Specific Outcome**				
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practic	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				will proved to decision in various part of agriculture	farming enterprises.	es.								
CO1- pg students will familiar with the knowledge of plant physiology.	3	3	3	3	3	1	1	1	3	3	1	2	3	1
CO2-students will able to acquaints knowledge about antitranspirant to check the loss of water.	3	3	3	2	3	1	1	1	3	3	1	3	2	1
CO3students will become expert to calculate the daily plant	3	2	1	3	2	3	1	1	3	3	2	2	1	2

growth by recording the growth data taken by auxanometer.														
CO 4 students will able to acquaint knowledge to distinguish between osmosis and diffusion process.	3	2	1	3	1	3	1	1	1	3	1	3	2	1
CO5-PG students will become expert in soil plant water relationship.	3	1	2	3	1	3	1	1	1	2	3	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Principles of plant physiology

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** pg students will familiar with the knowledge of plant physiology.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-1**. Water and its importance; molecular structure of water; properties and functions of water. Concept of water potential; plant cell and soil water potential and their components; methods to determine cell and soil water potential; concept of osmosis and diffusion. Soil physical properties and water availability in different soils; water holding capacity and approaches to improve WHC; concept of FC and PWP; Water holding polymers and their relevance. 1.1, 1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO2**-students will able to acquaints knowledge about antitranspirant to check the loss of water.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit-2** Root structure and functions; root architecture and relevance in water mining; mechanism of water absorption and translocation; theories explaining water absorption and trans location;aquaporins. Mycorrhizal association and its relevance in water mining. 1.1, 1.2,1.3,1.4,1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO3**students will become expert to calculate the daily plant growth by recording the growth data taken by auxanometer.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6**		**Unit-3** Evaporation and transpiration; relevance of transpiration; factors regulating transpiration; measurement of transpiration; approaches to minimize evaporation and transpiration; concept of CCATD and its relevance. Energy balance: solar energy input and output at crop canopy level. Stomata- its structure, functions and distribution; molecular mechanisms of stomata opening	As mentioned in page number ……..

				and closing; concept of Guard cell turgidity; role of k and other osmolytes; role of aba in stomatal closure; guard cells response to environmental signals; signaling cascade associated with stomatal opening and closure. Anti transparent and their relevance in agriculture. 1.1, 1.2,1.3,1.4,1.5,1.6	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO 4** students will able to acquaint knowledge to distinguish between osmosis and diffusion process.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit 4**. WUE and its relevance in water productivity; transpiration efficiency, a measure of intrinsic WUE; approaches to measure WUE; stomatal and mesophyll regulation on WUE; passioura's yield model emphasizing WUE 1.1, 1.2,1.3,1.4 1.5	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO5-**PG students will become expert in soil plant water relationship.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6**		**Unit 5** Physiology of water stress in plants; effect of moisture stress at molecular, cellular organ and plant level. Drought indices and drought tolerance strategies. Drought tolerance traits. 1.1, 1.2,1.3,1.4 1.5,1.6	As mentioned in page number ……..

Course Code: **STAT 512**

Course Title: **Experimental Designs**

Pre-requisite: Experimental design is the process of carrying out research in an objective and controlled fashion so that precision is maximized and specific conclusions can be drawn regarding a hypothesis statement. Generally, the purpose is to establish the effect that a factor or independent variable has on a dependent variable.

Rationale: Experimental design is used to establish the effect an independent variable has on a dependent variable. An experimental design helps a researcher to objectively analyze the relationship between variables, thus increasing the accuracy of the result.

Course Outcomes:

CO1 Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.

CO2 Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.

CO3 Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.

CO4 Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			Cl	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Program Core (PCC)	STAT 512	EXPERIMENTAL DESIGNS	2	01	02	01	6	3

Legend: **CI:** Class room Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:
Theory

Board of Study	Course Code	Course Title	**Scheme of Assessment (Marks)**						
			Progressive Assessment (PRA)					**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 1 number 5 marks each (CA)	Class Test 2 (2 best out) 15 marks each (CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT +PA+AT)	**(ESA)**	(PRA+ ESA)
PCC	STAT 512	ED	5	30	10	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self-Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

STAT 512 CO-1 Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources

Approximate Hours

Item	Appx. Hrs.
CI	3
LI	4
SW	1
SL	2
Total	10

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO1.1 Design of Experiment is a tool to develop an experimentation strategy that maximizes learning using a minimum of resources. **SO1.2** Extensively used by engineers and scientists involved in the improvement of manufacturing processes to maximize yield and decrease variability. **SO1.3** It is widely used in many fields with broad application across all the natural and social sciences, to name a few: Biostatistics, Agriculture, Marketing, Software engineering, Industry etc.	1-Uniformity trial data analysis. 2- formation of plots and blocks, Fairfield Smith Law	**Unit-1.** Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control. **1.1**. Need for designing of experiments **1.2** characteristics of a good design **1.3** Basic principles of designs- randomization, replication and local control	1. Prepare the assignment on Basic principles of designs- randomization, replication and local control.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Basic principles of designs- randomization, replication and local control.

b. Mini Project: -

c. Other Activities (Specify):-

STAT 512 CO-2 Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.

Approximate Hours

Item	Appx. Hrs.
CI	5
LI	6
SW	1
SL	2
Total	14

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Good experimental design is important in all research, it helps to ensure the data collection, data analysis and conclusions from a study, are valid (true). **SO2.2** Experiments are designed to test hypotheses, or specific statements about the relationship between variables.	1- Analysis of data obtained from CRD 2- - Analysis of data obtained from RBD 3- - Analysis of data obtained from LSD	**Unit-2** Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. **1.1** Uniformity trials **1.2** size and shape of plots and blocks **1.3**. Analysis of variance; Completely randomized design **1.4** Analysis of variance; randomized block design **1.5** Analysis of variance; Latin square design.	1. Prepare the assignment on Analysis of variance; Completely randomized design, randomized block design and Latin square design.

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Simple Problems Based on Analysis of variance; Completely randomized design, randomized block design and Latin square design.

a. Other Activities (Specify):

STAT 512 CO-3 Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.

Approximate Hours

Item	Appx. Hrs.
CI	6
LI	14
SW	1
SL	2
Total	23

Session Out Comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Experimental methods introduce erogeneity, allowing researchers to draw conclusions about the effects of an event or a program. **SO3.2** An experimental design helps a researcher to objectively analyze the relationship between variables, thus increasing the accuracy of the result.	1- Analysis of factorial experiments without confounding. 2- Analysis of factorial experiments with confounding. 3- Analysis with missing data in CRD. 4- Analysis with missing data in RBD. 5- Analysis with missing data in LSD. 6- Split plot designs. 7- Strip plot designs	**Unit-3** Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. **1.1**. Factorial experiments, (symmetrical) **1.2** Factorial experiments, (asymmetrical) **1.3** orthogonality **1.4** partitioning of degrees of freedom **1.5**. Confounding in symmetrical factorial experiments **1.6**. Factorial experiments with control	1. Prepare the assignment on Factorial experiments with control treatment.

SW-1 Suggested Sessional Work (SW):
Assignments: Prepare the assignment on Factorial experiments with control treatment.
Other Activities (Specify):

STAT 512 CO-4 Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.

Approximate Hours

Item	Appx Hrs.
CI	16
LI	6
SW	1
SL	2
Total	25

Session Out Comes (SOs)	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self-Learning (SL)**
SO4.1.Ensure your experiment is unbiased. **SO4.2** Make sure your experiment is adequately powered. **SO4.3** Consider the range of applicability of your experiment.	1- Transformation of data. 2- Analysis of resolvable designs 3- Fitting of response surfaces.	**Unit-4** Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design-concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures. **1.1** Split plot **1.2** strip plot designs **1.3** Analysis of covariance **1.4** Missing plot techniques in randomized block. **1.5** Missing plot techniques in Latin square designs. **1.6** Transformations **1.7** crossover designs **1.8** balanced incomplete block design **1.9** resolvable designs **1.10** Applications of resolvable designs Lattice design **1.11** Lattice design **1.12** Applications of	1. Prepare the assignment on Analysis of covariance and missing plot techniques in randomized block and Latin square designs

		Lattice design **1.13** Alpha design-concepts. **1.14** Randomization procedure. **1.15** Interpretation of results. **1.16** Response surfaces. Experiments with mixtures	

SW-1 Suggested Sessional Work (SW):

Assignments: Prepare the assignment on Analysis of covariance and missing plot techniques in randomized block and Latin square designs

Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	**Class Lecture (C l)**	**Laboratory Lecture (L I)**	**Sessional Work (SW)**	**Self Learning (S l)**	**Total hour (C l + LI+ SW +S l)**
CO1: Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	03	04	01	02	10
CO2: Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.	05	06	01	02	14
CO3: Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	06	14	01	02	25
CO4: Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.	16	06	01	02	25

Total Hours	**30**	**30**	**04**	**08**	**74**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit title	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO-1	Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	04	04	04	12
CO-2	Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive	04	04	04	12
CO-3	Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	04	04	04	12
CO-4	Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the	05	04	05	14

	applications of DOE and learn and apply these techniques in the field experiment.				
	Total	17	16	17	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Experimental Designs will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Demonstration
7. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
8. Brainstorming

Suggested Learning Resources:

S. No.	**Title**	**Author**	**Publisher**	**Edition &** Year
01	Basic Concepts and Application of Experimental Designs and Analysis	Felix Kusanedzie Sylverster Achio Edmund Ameko	Science PG	
02	Theory and Analysis of Experimental Designs	B.L. Agrawal	CBS	
03	Design and Analysis of Experiments	Angela Dean Daniel Voss	Springer	

Curriculum Development Team:

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Cos, POs and PSOs Mapping
Course Code:- STAT 512
Course Title: - Experimental Designs

Course Outcomes	**Program Outcomes**									**Program Specific Outcome**				
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farmi	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agricult	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepre	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				which will proved to decision in various part of agriculture	ng enterprises.	practices.			ure.	neurship.				
CO1: Understand of basic concepts of design of experiments. Introduction to planning valid and economical experiments within given resources.	1	2	1	3	1	3	3	3	3	3	1	2	3	3
CO2: Analyze completely	1	2	1	3	1	3	3	3	3	3	1	2	3	3

randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.														
CO3: Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	1	2	1	3	1	3	3	3	3	3	1	2	3	3
CO4: Understand the purpose for balanced	1	2	1	3	1	3	3	3	3	3	1	2	3	3

incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.														

Course Curriculum Map: Experimental Designs

POs & PSOs No.	**COs No.& Titles**	**SOs No.**	**Laboratory Instruction(LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4,	**CO1**: Understand of basic concepts of design of	**SO1.1** **SO1.2** **SO1.3**		**Unit-1**. Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control. 1.1, 1.2,1.3.	As mentioned in page number

5	experiments. Introduction to planning valid and economical experiments within given resources.				……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO2:** Analyze completely randomized design, Randomized block design, Latin square design. The conditions and circumstances under which results of the experiment are valid should be extensive.	**SO2.1** **SO2.2**		**Unit-2 2** Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. 1.1, 1.2,1.3,1.4,1.5.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO3:** Understand and compute Full and confounded factorial designs with two and three levels. Fractional factorial designs with two levels.	**SO3.1** **SO3.2**		**Unit-3**. Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. 1.1, 1.2,1.3,1.4,1.5,1.6	As mentioned in page number ……..

PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO4:** Understand the purpose for balanced incomplete block design, resolvable designs and their applications. Split and Strip plot design will help students to know the applications of DOE and learn and apply these techniques in the field experiment.	**SO4.1** **SO4.2** **SO4.3**		**Unit 4** Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design-concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures. 1.1, 1.2,1.3,1.4 1.5,1.6,1.7,1.8,1.9,1.10,1.11,1.12,1.13,1.14,1.15,1.16,1.17.	As mentioned in page number ……..

A K S University
Faculty of Agricultural Science and Technology
Department of Agronomy
Curriculum of M.Sc. (All Branches)

Course Code: **PGS 503**
Course Title: **Intellectual Property and Its Management in Agriculture**
Pre- requisite: To teach the physiology of Intellectual Property and Its Management in Agriculture
Rationale: 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:

PGS 503.1: Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.

PGS 503.2: Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.

PGS 503.3: Students will be able to understand Research Collaboration Agreement, License agreement

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits(C)
			Cl	LI	SW	SL	Total Study Hours(CI+LI+ SW+SL)	
Program Core (PGS)	PGS 503	Intellectual Property and Its Management in Agriculture	1	0	1	1	3	1

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and

feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Theory

Board of Study	Course Code	Course Title	**Scheme of Assessment (Marks)**						
			Progressive Assessment(PRA)					**End Semester Assessment**	**Total Marks**
			Class/Home Assignment 1number 5 marks each (CA)	Class Test2 (2bestout) 20 marks each(CT)	Practical Exam (PA)	Class Attendance (AT)	Total Marks (CA+CT+PA+AT)	**(ESA)**	PRA+ESA)
PGS	PGS 503	Intellectual Property and Its Management in Agriculture	5	40	0	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes(SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

PGS 503.1: Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.

Approximate Hours

Item	AppX Hrs
Cl	04
LI	0
SW	01
SL	02
Total	07

Session Outcomes(SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self-Learning (SL)
SO1.1 Student will understand the Historical perspectives and need for the introduction of Intellectual Property Right. **SO1.2** Student will recognize the TRIPs and various provisions in TRIPS Agreement. **SO1.3** Student will understand different Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs		**Unit-1.** Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs. **1.1** Historical perspectives and need for the introduction of Intellectual Property Right regime. **1.2** TRIPs and various provisions in TRIPS Agreement. **1.3** Intellectual Property and Intellectual Property Rights (IPR). **1.4** Benefits of securing IPRs.	1. Role of IPR and its benefits. 2. Role of TRIPS and its benefits

SW-1 Suggested Sessional Work (SW):
Assignments:

I. Preparation of file and write the role of IPR and TRIPS and their purpose.

PGS 503.2: Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.

Approximate Hours

Item	AppXHrs
Cl	06
LI	0
SW	02
SL	03
Total	11

Session Outcomes(SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self - Learning(SL)

SO2.1 Students will understand the Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout **SO2.2**Students will understand the trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection. **SO2.3** Students will identify the role of Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.		**Unit-2** Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. **2.1** Indian Legislations for the protection of various types of Intellectual Properties. **2.2** Fundamentals of patents, copyrights, geographical indications, designs and layout. **2.3** trade secrets and traditional knowledge and trademarks. **2.4** protection of plant varieties and farmers' rights and biodiversity protection. **2.5** Protectable subject matters, protection in biotechnology. **2.6** protection of other biological materials, ownership and period of protection.	1. Basic Indian Legislature. 2. Plant varieties and farmers' rights act (2001). 3. Biodiversity act (2002).

SW-2 Suggested Seasonal Work (SW):

Assignments:

I. Note on Plant varieties and farmers' rights act (2001).

II. Note on Biodiversity act (2002).

PGS 503.3: Students will be able to understand Research Collaboration Agreement, License agreement

Approximate Hours

Item	AppXHrs
Cl	05
LI	0
SW	02
SL	01
Total	08

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Students will identify the National Biodiversity protection initiatives and Convention on Biological Diversity. **SO3.2** Students will understand the International Treaty on Plant Genetic Resources for Food and Agriculture and Licensing of technologies. **SO3.2** Students will understand the Material transfer agreements, Research collaboration Agreement and License Agreement.		**Unit-3:** 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. **3.1** National Biodiversity protection initiatives. **3.2** Conventions on Biological Diversity. **3.3** International Treaty on Plant Genetic Resources for Food and Agriculture. **3.4** Licensing of technologies and Material transfer agreements. **3.5** Research collaboration Agreement and License Agreement.	1. Plant Genetic Resources.

SW-3 Suggested Sessional Work (SW):

a. **Assignments**:

i. Note on Plant Genetic Resources.

ii. Note on National Biodiversity protection initiatives

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Sessional Work (SW)	Self-Learning (Sl)	Total hour (Cl+SW+Sl)
CO1- Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.	04	01	02	07
CO.2: Students will be able to	06	02	03	11

understand National Biodiversity protection initiatives. Convention on Biological Diversity.				
CO.3 Students will be able to understand Research collaboration Agreement, License agreement.	05	02	01	08
Total	**15**	**05**	**06**	**26**

Suggestion for End Semester Assessment

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO 1	**Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs.**	05	03	02	**10**
CO 2	**Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.**	05	02	03	**10**
CO 3	**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.**	05	03	02	**10**

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for **Intellectual Property and Its Management in Agriculture** will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to organic fields
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Facebook, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Intellectual Property Rights in Agricultural Biotechnology	• Erbisch FH and Maredia K	CABI.	1998
2	Intellectual Property Rights: Unleashing Knowledge Economy	• Ganguli P	McGraw-Hill.	2001
3	Intellectual Property Rights: Key to New Wealth Generation		NRDC and Aesthetic Technologies.	2001
4	State of Indian Farmer. Vol. V. Technology Generation and IPR Issues	• Ministry of Agriculture, Government of India	Academic Foundation	2004
5	Intellectual Property Rights in Animal Breeding and Genetics	• Rothschild M and Scott N	CABI	2003

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Cos, POs and PSOs Mapping
Course Code:- PGS 503
Course Title: Intellectual Property and Its Management in Agriculture

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation whi	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practi	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanic	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agricult

				ch will proved to decision in various part of agriculture	enterprises.	ces.				s of agri Entrepreneurship.				ure
CO1- Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.	1	3	1	2	1	3	3	1	3	1	3	3	3	2
CO.2: Students will be able	1	3	1	2	1	3	3	1	3	1	3	3	3	2

to understand National Biodiversity protection initiatives. Convention on Biological Diversity.														
CO.3 Students will be able to understand Research collaboration Agreement, License agreement.	1	3	1	2	1	3	3	1	3	1	3	3	3	2

Course Curriculum Map: Intellectual Property and Its Management in Agriculture

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** Students will be able to understand Historical perspectives and need for the introduction of Intellectual Property Right.	**SO1.1 SO1.2 SO1.3**		**Unit-1**. Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs. 1.1, 1.2,1.3,1.4	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO.2:** Students will be able to understand National Biodiversity protection initiatives. Convention on Biological Diversity.	**SO2.1 SO2.2 SO2.3**		**Unit-2**. Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. 1.1, 1.2,1.3,1.4,1.5,1.6.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9	**CO.3** Students will	**SO3.1 SO3.2**		**Unit-3**. National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture;	As mentioned in page number ……..

PSO 1,2, 3, 4, 5	be able to understand Research collaboration Agreement, License agreement.	**SO3.3**		Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement1.1, 1.2,1.3,1.4,1.5,1.6	

A K S University
Faculty of Agricultural Science and Technology
Department of Biochemistry and Crop Physiology
Curriculum of M.Sc. (All Branches)

Course Code: PGS504
Course Title: Basic Concept in laboratory
Pre requisite: No specific requirements
Rationale: Studying basic laboratory techniques are fundamental for scientific research, ensuring accurate experimentation and data analysis. Mastery of these skills cultivates precision, reproducibility, and safety, forming the cornerstone of scientific inquiry across disciplines and facilitating advancements in knowledge and technology.

Course Outcomes: **CO1_PGS504** Student will learn about basic instrumentation, its principles, working and use. They will learn about Making solutions of different concentrations, learn acid base interaction. Also, students will learn about Procedural outline of various experiments. Student will learn about Basics of plant tissue culture and seed viability testing.

Scheme of Studies:

Board Of Study	**Course Code**	**Course Title**	**Scheme of Studies (Hours/Week)**					**Total Credit (C)**
			CI	LI	SW	SL	Total Study Hours	
NC	PGS504	Basic Concepts in Laboratory Techniques	00	2	00	00	2	01

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e.Lecture (L)and Tutorial (T)and others),
LI: LaboratoryInstruction(IncludesPracticalperformancesinlaboratoryworksh op, field or other locations using different instructional strategies)
SW: Sessional Work(includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacherto ensure outcome of Learning.

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Scheme of Assessment:
Practical

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						**End Semester Assessment** (ESA)	**Total Marks** (PRA + ESA)
			Class/Home Assignment 5 number3 mark seach(CA)	Class Test 2 (2 best out of3) 10 marks each(CT)	Seminar one	Class Activity anyone (CAT)	Class Attendance (AT)	Total Marks (CA+CT+SA+CAT+AT)		
NC	PGS 504	Basic Concepts in Laboratory Techniques							100	100

Course-Curriculum Detailing:

Laboratory techniques are important for any person conducting an experiment. Every procedure needs to be complete with accuracy and precision with proper safety measures. Student will understand the safety and details of working in scientific laboratory. Student will familiarize with various instruments and their principles. Student will practice and visualize common experimental procedures.

PGS504 **Basic Concept of Laboratory Techniques**

Approximate Hours

Item	Appx Hrs
CI	00
LI	30
SW	00
SL	00
Total	30

Session Outcomes (SOs)	**Laboratory Instructions (LI) 1 class= 2 hrs.**	**Classroom Instructions (CI)**	**Self-Learning (SL)**
SO.L1 Identify safety measures while in Lab SO.L2 Recognize use of glassware. SO.L3 Discover handling of glassware. SO.L4 Recognize Drying of solvents/ chemicals;	L1. Safety measures while in Lab; L2. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; L3. Washing, drying and sterilization of glassware; L4. Drying of solvents/		

SO.L5 Describe working with chemicals. SO.L6 Describe working with solutions. SO.L7 Articulate the technique of formulating doses of agrochemicals SO.L8 Discover handling techniques of solutions SO.L9 Identify the handling of acid and bases SO.L10 Discover the formulation of buffer and solutions of specific pH. SO.L11 Identify the use of lab instruments SO.L12 Recognize and categorize the media requirements and its types SO.L13 Discover the methods and application of viability of germ plasm SO.L14 Illustrate procedure for plant tissue culture SO.L15 Recognize flowering plant by its taxonomical description	chemicals; L5. Handling of chemical substances; Weighing and preparation of solutions of different strengths and their dilution; L6. Handling techniques of solutions; L7. Preparation of different agro-chemical doses in field and pot applications; L8. Preparation of solutions of acids; L9. Neutralisation of acid and bases; L10. Preparation of buffers of different strengths and pH values; L11. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthling; L12. Preparation of media and methods of sterilization; L13. Seed viability testing, testing of pollen viability; L14. Tissue culture of crop plants; L15. Description of flowering plants in botanical terms in relation to taxonomy		

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class lecture (CL)	Sessional Work (SW)	Self-Learning (SL)	Total hour (CL+SW+SL)
Basic Concept of Laboratory Techniques	0+30	0	0	30

Suggestion for End Semester Assessment:

Suggested Specification Table (For ESA)

CO	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
CO1	**Basic Concept of Laboratory Techniques**		**30**	**70**	**100**

Suggested Learning Resources:

Sl. No.	Title	Author	Publisher	Edition and Year
01	Laboratory Techniques in Organic Chemistry	Jerry R. Mohrig, David G. Alberg, and Gretchen M. Adams	W. H. Freeman and Company.	2014
02	Biotechnology: Expanding Horizons	B D Singh	Kalyani Publishers	2005

Curriculum Development Team

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Cos, POs and PSOs Mapping
Course Code:- PGS504
Course Title: - Basic concept in laboratory

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprenurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				of agriculture										
CO1- Basic Concept of Laboratory Techniques	1	1	1	1	1	1	1	3	1	1	1	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Basic concept in laboratory

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** Basic Concept of Laboratory Techniques .	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5** **SO1.6** **SO1.7** **SO1.8** **SO1.9** **SO1.10** **SO1.11** **SO1.12** **SO1.13** **SO1.14** **SO1.15**		**Unit-1** 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 agrochemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps,viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electricwiring 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 relationto taxonomy	As mentioned in page number ……..

A K S University
Faculty of Agricultural Science and Technology
Department of Agronomy
Curriculum of M.Sc. Agronomy

Course Code: Agron 599

Course Title: Research/Thesis

Pre- requisite: Conduct research to resolving the problem of farmers and society by applying advanced technology adopted in field of Agronomy.

Rationale: The basic purpose of master's research is to understand the application of research methodology tools to do research on particular topic related to Agronomy and follow technical writing skill to design the synopsis, thesis, research paper, abstract, articles, etc as per results obtained during research studies.

Course Outcomes:

AGRO 599.1. Prepare various research activities related to Agronomy field and compose manuscript i.e., synopsis related to particular topic.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study HoursCI+LI+SW+ SL	
	AGRO 599	Master Research	0	30	0	0	30	(0+15)= 15

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),**LI:** Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)**SW:** Sessional Work (includes assignment, seminar, mini project etc.),**SL:** Self Learning,**C:**Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks(PRA + ESA)
			Class/Home Assignment 5 number3 markseach (CA)	ClassTest 2(2 bestoutof3)10 marks each(CT)	Seminarone	Class Activityanyone(CAT)	Class Attendance(AT)	Total Marks(CA+CT+SA+ CAT+AT)		
	AGRO 599	Master Research	0	0	0	0	0	0	100	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

AGRO 599. 1 Prepare various research activities related to Agronomy field and compose manuscript i.e., synopsis related to particular topic.

Approximate Hours

Item	Approximate Hours
CI	**0**
LI	**30**
SW	**0**
SL	**30**
Total	**60**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1. Plan the proposal of research related to the topic taken with the help of guide SO2. Design the layout according to topic SO3. Describe the terminology related to the topic SO4. Plan the methodology to conduct the research on the topic SO5. Select the data to be taken during research	**1.1.** Submission of research proposal consisting concern programme **1.2**. Explain definition of the problems reference to topic **1.3**. Explanation of results **1.4**. Arrange the references of past work of 10 years **1.5**. Collection of data by focusing their objectives and observations to be taken mentioned in their synopsis		**1.**Finding of reviews related with the topic of research. **2.**Preparation of manuscripts related to concerned topic.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
AGRO 599.1 Prepare various research activities related to Agronomy field and compose manuscript i.e., synopsis related to particular topic.		**30**	**30**	**60**

Total		30	30	60

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Group Discussion
3. Demonstration
4. Brainstorming

Suggested Learning Resources:

(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Research publications			
2	Science direct			
3	Research gate			
4	Pubmade			
5	Academia			
6	Multi authored books			
7	Book chapters			

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Cos, POs and PSOs Mapping
Course Code:- Agron 599
Course Title: Research/Thesis

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part of agric	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modernit tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprenurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				ultur e										
CO1-Prepare various research activities related to Agronomy field and compose manuscript i.e., synopsis related to particular topic..	2	3	3	2	3	3	2	1	3	3	3	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Research/Thesis

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1-** Prepare various research activities related to Agronomy field and compose manuscript i.e., synopsis related to particular topic.. .	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	Submission of research proposal consisting concern programme Explain definition of the problems reference to topic Explanation of results Arrange the references of past work of 10 years Collection of data by focusing their objectives and observations to be taken mentioned in their synopsis 1.1,1.2,1.3,1.4,1.5		As mentioned in page number ……..

A K S University
Faculty of Agricultural Science and Technology
Department of Agronomy
Curriculum of M.Sc. (All Branches)

Course Code: - **PGS 505**

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

Pre requisite: - Student should have basic knowledge of agricultural research, research ethics, and agricultural history along with fellowship program, rural development programme.

Rationale: - The students studying agricultural research and research ethics should possess understanding about method of research application, research ethics and fellowship for research and other scholars in construction agricultural development. This encompasses familiarity with the invention and evolution of agricultural research and development of agricultural programme, students ought to acquire fundamental insights into various agricultural technologies, their applications, as well as the Indian needs in agricultural developments.

Course Outcomes:
PGS 505 CO 1: Identify the history, levels of research, economic and social welfare through research programme.
PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.
PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.
PGS 505 CO 4**:** Analyze the various development programmes and their functioning with its impact on agricultural development
PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.

Scheme of studies

Categories of course	Course Code	Course Title	Scheme of studies (Hours/Week)					Total Credits (C)
			C l	LI	SW	SL	Total Study Hours (CI+LI+SW+SL)	
Non credit course (NCC)	**PGS 505**	Agricultural Research, Research Ethics and Rural Development Programmes	01	00	02	01	04	01

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),

LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Scheme of Assessment:

Categories of course	Course Code	Course Title	**Scheme of Assessment (Marks)**							
			Progressive Assessment (PRA)						**End Semester Assessment (ESA)**	**Total Marks** (PRA+ ESA)
			Class/ Home Assignment 5 number 3 marks each (CA)	**Class Test 2 (2 best out of 3) 10 marks each (CT)**	**Seminar one (SA)**	**Class Activity any one (CAT)**	**Class Attendance (AT)**	**Total Marks (CA+CT+SA+CAT+AT)**		
(NCC)	**PGS 505**	Agricultural Research, Research Ethics and Rural Development Programmes	15	30	00	00	5	50	50	100

Course-Curriculum Detailing:

This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

PGS 505 CO-1 Identify the history, levels of research, economic and social welfare through research programme

Approximate Hours

Item	Appx Hrs
C l	3
LI	0
SW	2
SL	1
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1- Introduce about the history of agriculture in brief **SO1.2 -** Brief the basic concept global agricultural research system. **SO1.3 - Discuss** about the need, scope, opportunities; Role in promoting food security of global agricultural research system. **SO1.4-** Describes the reducing poverty and protecting the environment through global agricultural research system **SO1.5** Asses the functions and use of national Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions.		**Unit-I** **History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions;** **1.1-** History of agriculture in brief **1.2-**Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment **1.3-** National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions	**1.1-** Prepare the assignment on Global agricultural research system

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Global agricultural research system

b. Mini Project: -

c. Other Activities (Specify):-

PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.

Approximate Hours

Item	AppX Hrs
C l	3
LI	0
SW	1
SL	2
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 – introduce to the Consultative Group on International Agricultural Research (CGIAR) **SO2.2 –** learned about the International Agricultural Research Centers (IARC), **SO2.3-** Briefing the partnership with NARS, role as a partner in the global agricultural research system **SO2.4-** Briefing the strengthening capacities at national levels; International fellowships for scientific mobility **SO 2.5–**Discuss to the strengthening capacities at regional levels; International fellowships for scientific mobility	**LE2.1**	**Unit-II** **Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (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** **2.1 -** Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (IARC) **2.2-** Partnership with NARS, role as a partner in the global agricultural research system. **2.3-,** Strengthening capacities at national and regional levels; International fellowships for scientific mobility.	**2.1 –** Prepare the assignment on partnership with NARS, role as a partner in the global agricultural research system

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on partnership with NARS, role as a partner in the global agricultural research system.

b. Mini Project:

c. Other Activities (Specify):

PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.

Approximate Hours

Item	AppX Hrs
C l	3
LI	0
SW	2
SL	1
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 – Identify to the Research ethics **SO3.2 –** Discuss to the research integrity, research safety in laboratories **SO3.3-** Apply the welfare of animals used in research **SO3.4-** Discuss to computer ethics and standards **SO3.5**– Describe the problems in research ethics	**LE3.1**	**Unit-3** **Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics** **3.1-**Research ethic and research integrity **3.2-** Research safety in laboratories, welfare of animals used in research. **3.3-** Computer ethics, standards and problems in research ethics.	**3.1** Prepare the assignment on Research ethic and research integrity.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Research ethic and research integrity

b. Mini Project:

c. Other Activities (Specify)

PGS 505 CO 4: Analyze the various development programmes and their functioning with its impact on agricultural development

Approximate Hours

Item	App X Hrs
Cl	3
LI	0
SW	2
SL	1
Total	06

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 –Identify the Concept and connotations of rural development. **SO1.2 -** Apply the rural development policies and strategies **SO1.3-** Asses the Rural development programmes: Community Development Programme, Intensive Agricultural District Programme. **SO1.4-** Describes the Special group – Area Specific Programme. **SO1.5**– Brief the Integrated Rural Development Programme (IRDP)	**LE1.1** -	**Unit-4.0 - I** **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)** **4.1-** Concept and connotations of rural development, rural development policies and strategies **4.2-** Rural development programmes: Community Development Programme, Intensive Agricultural District Programme **4.3-** Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP)	**1.1-** Prepare the assignment on Community Development Programme.

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Community Development Programme

b. Mini Project: Prepare a project report of leadership styles and influence process; leadership theories, leadership styles and effective leader

c. Other Activities (Specify):

PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.

Approximate Hours

Item	AppX Hrs
Cl	06
LI	00
SW	02
SL	02
Total	10

Session Outcomes (SOs)	**Laboratory Instruction (LI)**	**Class room Instruction (CI)**	**Self Learning (SL)**
SO1.1 –Indentify Panchayati Raj Institutions and Co-operatives. **SO1.2-** Identify the Voluntary Agencies **SO1.3-** Identify the Non-Governmental Organizations **SO1.4-** Discuss the , Critical evaluation of rural development policies **SO1.5-** Briefs the programmes. Constraints in implementation of rural policies and programmes	**LE1.**	**Unit-5.0** **Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes** **5.1-** Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations **5.2-** Critical evaluation of rural development policies and programmes **5.3-** Constraints in implementation of rural policies and programmes	**1.1 -** Prepare the assignment on Panchayati Raj Institutions,

SW-1 Suggested Sessional Work (SW):

a. Assignments: Prepare the assignment on Panchayati Raj Institutions,

b. Mini Project:

c. Other Activities (Specify):

Brief of Hours suggested for the Course Outcome

Course Outcomes	**Class Lecture (C l)**	**Laboratory Lecture (L I)**	**Sessional Work (SW)**	**Self Learning (S l)**	**Total hour (C l + LI+ SW +S l)**

PGS 505 CO-1 Identify the history, levels of research, economic and social welfare through research programme	3	0	2	1	06
PGS 505 CO 2: Apply the functioning, role and significant of regional, national and international research.	3	0	2	1	06
PGS 505 CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.	3	0	2	1	06
PGS 505 CO 4: Analyze the various development programmes and their functioning with its impact on agricultural development	3	0	2	1	06
PGS 505 CO 5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.	3	0	2	1	06
Total Hours	**15**	**00**	**10**	**05**	**30**

Suggested Specification Table (For ESA)

CO	Unit title	**Marks Distribution**			**Total Marks**
		R	**U**	**A**	
CO-1	Identify the history, levels of research, economic and social welfare through research programme.	02	03	00	05
CO-2	Apply the functioning, role and significant of regional, national and international research.	02	05	03	10
CO-3	Asses the agricultural research, research ethics with operating and safety of laboratory.	00	08	07	15
CO-4	Analyze the various development programmes and their functioning with its impact on agricultural development.	02	05	08	15
CO-5	Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program	00	03	02	05
	Total	06	24	20	50

Legend: R: Remember, U: Understand, A: Apply

The end of semester assessment for Introduction to Portland cement will be held with written examination of 50 marks

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.

Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Role Play
6. Visit to Industry
7. Demonstration
8. ICT Based Teaching Learning (Video Demonstration/Tutorials CBT, Blog, Face book, Twitter, Whatsapp, Mobile, Online sources)
9. Brainstorming

Suggested Learning Resources:

S. No.	**Title**	**Author**	**Publisher**	**Edition &** Year
01	Indian Agriculture - Four Decades of Development	Bhalla GS & Singh G.	Sage Publ	2001
02	Manual on International Research and Research Ethics	Punia MS	CCS, Haryana Agricultural University, Hisar.	
03	Rural Development Strategies and Role of Institutions Issues, Innovations and Initiatives.	Rao BSV.	Mittal Publ	2007
	Rural Development - Principles, Policies and Management	Singh K..	Sage Publ	1998.

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Cos, POs and PSOs Mapping
Course Code:- PGS 505
Course Title: - Agricultural Research, Research Ethics and Rural Development Programmes

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part of agriculture	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entreprenurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

CO-1 Identify the history, levels of research, economic and social welfare through research programme	3	3	3	1	3	1	1	1	3	3	1	2	3	1
CO 2: Apply the functioning, role and significant of regional, national and international research.	3	3	3	2	3	1	1	1	3	3	1	3	2	1
CO 3: Asses the agricultural research, research ethics with operating and safety of laboratory.	3	2	1	3	2	3	1	3	3	3	2	2	1	2
CO 4: Analyze the various development programmes and their functioning with its impact on	3	2	1	3	1	3	1	1	1	3	1	3	2	1

agricultural development														
CO5: Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.	3	1	2	3	1	3	1	1	1	2	3	1	1	1

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Agricultural Research, Research Ethics and Rural Development Programmes

POs & PSOs No.	**COs No.& Titles**	**SOs No.**	**Laboratory Instruction (LI)**	**Classroom Instruction (CI)**	**Self Learning (SL)**
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1:** Identify the history, levels of research, economic and social welfare through research programme	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-1.0** History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions 1.1, 1.2, 1.3.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO 2:** Apply the functioning, role and significant of regional, national and international research.	**SO1.1** **SO1.2** **SO1.3** **SO1.4**		**Unit-2.0 –** Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities	As mentioned in page number ……..

		SO1.5		at national and regional levels; International fellowships for scientific mobility 2.1, 2.2, 2.3.	
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO 3:** Asses the agricultural research, research ethics with operating and safety of laboratory.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-3.0** Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics 3.1, 3.2, 3.3.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO 4:** Analyze the various development programmes and their functioning with its impact on agricultural development	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-4.0** 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) 4.1, 4.2, 4.3.	As mentioned in page number ……..
PO 1,2,3,4,5,6 7,8,9,10,11,12 PSO 1,2, 3, 4, 5	**CO 5:** Evaluate the role and functioning of panchayati raj, NGO and evaluation of different rural development program.	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**		**Unit-5.0** Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes 5.1, 5.2, 5.3.	As mentioned in page number ……..

A K S University
Faculty of Agricultural Science and Technology
Department Of Agronomy
Curriculum of M.Sc. Agronomy

Course Code: **AGRO 599**
Course Title: **Research/Thesis**
Pre- requisite: Conduct research to resolving the problem of farmers and society by applying advanced technology adopted in field of Agronomy .
Rationale: The basic purpose of master's research is to understand the application of research methodology tools to do research on particular topic related to Agronomy and follow technical writing skill to design the synopsis, thesis, research paper, abstract, articles, etc as per results obtained during research studies.

Course Outcomes:

Agro 599 Propose research methodology tools for conducting research on selected topic of field of Agronomy and prepare Final manuscript i.e. Thesis

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(Hours/Week)					Total Credits (C)
			CI	LI	SW	SL	Total Study Hours CI+LI+SW+SL	
	AGRO 599	Master Research	0	30	0	0	30	(0+15)= 15

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others),
LI: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)
SW: Sessional Work (includes assignment, seminar, mini project etc.),
SL: Self Learning,
C: Credits.

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

Board of Study	Course Code	Course Title	Scheme of Assessment (Marks)							
			Progressive Assessment (PRA)						End Semester Assessment (ESA)	Total Marks(PRA + ESA)
			Class/Home Assignment 5 number3 mark each (CA)	Class Test 2(2 best out of3)10 marks each(CT)	Seminar one	Class Activity anyone(CAT)	Class Attendance(AT)	Total Marks (CA+CT+SA+ CAT+AT)		
	Agro-599	**Master Research**	0	0	0	0	0	0	100	100

Course-Curriculum Detailing:
This course syllabus illustrates the expected learning achievements, both at the course and session levels, which students are anticipated to accomplish through various modes of instruction including Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW), and Self Learning (SL). As the course progresses, students should showcase their mastery of Session Outcomes (SOs), culminating in the overall achievement of Course Outcomes (COs) upon the course's conclusion.

Agro- 599 Propose research methodology tools for conducting research on selected topic of field of Agronomy.

Approximate Hours

Item	Approximate Hours
CI	**0**
LI	**30**
SW	**0**
SL	**30**
Total	**60**

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1. Choose the topic and objectives for the research SO2. Select the suitable data during the research	**1.1** Perform research work as per their topic by using various tools and production technology methods in particular season of		**1.**Finding of reviews related with the topic of

SO3. Assemble the data taken during the research for interpretation SO4. Arrange the whole work with the interpretate data SO5. Formulate the hypothesis according the final composition.	crop. **1.2**. Collection of data **1.3**. Analysis and interpretation of data **1.4**. Submission of final thesis based on the research topic		research. **2.**Preparation of manuscripts related to concerned topic.

Brief of Hours suggested for the Course Outcome

Course Outcomes	Class Lecture (Cl)	Lab Instruction (LI)	Self Learning (Sl)	Total hour (Cl+SW+Sl)
AGRO 599 Propose research methodology tools for conducting research on selected topic of field of Agronomy.		**30**	**30**	**60**
Total		**60**	**60**	**60**

Note. Detailed Assessment rubric need to be prepared by the course wise teachers for above tasks. Teachers can also design different tasks as per requirement, for end semester assessment.
Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Group Discussion
3. Demonstration
4. Brainstorming

Suggested Learning Resources:
(a) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Research publications			
2	Science direct			
3	Research gate			
4	Pub made			
5	Academia			
6	Multi authored books			
7	Book chapters			

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Cos, POs and PSOs Mapping
Course Code:- AGRO 599
Course Title: Research/Thesis

Course Outcomes	Program Outcomes									Program Specific Outcome				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
	Specific knowledge of various branches of agronomy will be made specialized and to provide knowledge dissemination regarding various technique of farming and farming system in India	Wide knowledge in the concerning subject which will improve the farmers condition through student's contributions.	Detailed knowledge regarding package and practices soil fertilizer and water management of productive crop aspects.	Use appropriate scientific methods collaboration with statistics along with evaluation which will proved to decision in various part	Detailed knowledge of cultivation practices, soil, fertilizers, water management and plant protection economic associated with farming enterprises.	Create, select and apply an appropriate techniques, resources and modern it tools in improvement of agronomical package and practices.	Student will apply various statistical methods to analyze their master research work	Student will apply basic concepts in laboratory techniques during their research work	Understand the impact of the professional expert solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development in Agriculture.	Enable to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agri Entrepreneurship.	Acquainting with basic concepts theories and terminology of Agronomy.	To undertake teaching research and extension activates along with administrative and consultancy services.	Apply research and expertise in resolving the problems of existing farm in the periphery of universities.	To understand and analyze the current issues that are occurring in local and global agriculture and how they will affect futuristic agriculture

				of agriculture										
CO1- 599 Propose research methodology tools for conducting research on selected topic of field of Agronomy.	2	3	3	2	3	3	2	1	3	3	3	2	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

Course Curriculum Map: Research/Thesis

POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction(LI)	Classroom Instruction (CI)	Self Learning (SL)
PO 1,2,3,4,5,6 7,8,9 PSO 1,2, 3, 4, 5	**CO1- 599** Propose research methodology tools for conducting research on selected topic of field of Agronomy. .	**SO1.1** **SO1.2** **SO1.3** **SO1.4** **SO1.5**	Perform research work as per their topic by using various tools and production technology methods in particular season of crop. Collection of data analysis and interpretation of data Submission of final thesis based on the research topic 1.1,1.2,1.3,1.4		As mentioned in page number …….