



**Evaluation Scheme & Syllabus**  
**of**  
**M.Sc. Ag. (Agronomy)**  
**Course Curriculum**

*(w.e.f. Academic Session 2022-2023)*

**Department of Agriculture**  
**INVERTIS UNIVERSITY- INVERTIS VILLAGE**  
**Bareilly- Lucknow NH-24, Bareilly**

### Program Outcomes of M.Sc. (Agriculture) Agronomy

- ❖ **Soil management:** In this program student learn about soil mineralogy, genesis, classification, survey as well as management of problematic soils. It also deals with soil fertility and nutrient management practices.
- ❖ **Organic farming:** It provides a wide knowledge about different kind of organic manures and their efficient utilization in various cropping systems.
- ❖ **Weed management:** It enables the students to attain knowledge on basic principles and modern practices of weed management
- ❖ **Water management:** To teach the students about principles of water management of the crops and cropping systems, practices to enhance the water use efficiency
- ❖ **Crop management system:** Students learn about different cropping (oil seeds, fibers, legumes, cereals etc.) as well as farming system (IFS, organic farming, conservation farming etc.) and their modern concepts and principles. In this program students also learn about different kinds of crop production practices, their management as well as their interaction with allied sectors of agriculture. Student can work in Government Sector specially in Agriculture Department and different private sectors viz, pesticide companies, fertilizer companies, seed also in seed production sectors.

## Examination Scheme (First Semester)

<b>I Semester (Credit hours distribution)</b>			
S.No	Course Code	Course Title	Credit Hours
1.	MAGR-101	Modern Concepts in Crop Production	3 (3+0)
2.	MAGR -102	Principles and Practices of Soil Fertility and Nutrient Management	3(2+1)
3.	MAGR -103	Principles and Practices of Weed Management	3(2+1)
4.	MAGR-104	Principles and Practices of Water Management	3(2+1)
5.	MAGR-105	Experimental Design	3(2+1)
6.	MAGR-106	Basic Concepts in Laboratory Techniques	1(0+1) *
7.	MAGR-107	Library and Information Services	1(0+1) *
8.	MAGR-460	Master's Research	3(0+3) *
<b>Total Credit</b>			<b>20 (11+4+5*)</b>
<b>*-Non gradial, (11+4+5*)-:11 lectures, 9 practicals (4 Main practicals+ 5 Non gradial practicals)</b>			

<b>Evaluation Scheme</b>									
Course code	Course title	C	L	P	PM	UT	ESM	T	MP
MAGR-101	Modern Concepts in Crop Production	3	3	0	-	50	50	100	10.0
MAGR -102	Principles and Practices of Soil Fertility and Nutrient Management	3	2	1	20	30	50	100	10.0
MAGR -103	Principles and Practices of Weed Management	3	2	1	20	30	50	100	10.0
MAGR-104	Principles and Practices of Water Management	3	2	1	20	30	50	100	10.0
MAGR-105	Experimental Design	3	2	1	20	30	50	100	10.0
MAGR-106	Basic Concepts in Laboratory* Techniques	1	-	1	100			100	S
MAGR-107	Library and Information Services*	1	-	1	100			100	S
MAGR-460	Master's Research*	3	0	3	-	-	-	-	S
C-Credit, L-Lecture, P-Practical, PM-practical Marks UT-Unit test, ESM: End semester marks, MP: Maximum Points, S: Satisfactory									

**MAGR- 101 MODERN CONCEPTS IN CROP PRODUCTION**

<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures and Practical: 3 hr./ week (3+0) Tutorials: Nil Credits: 3	Unit Test: 50Marks End Semester Exam:50Marks

**Course objective:**

1. To teach the basic concepts of soil management and crop production.

**Theory:****UNIT I**

Crop growth analysis in relation to environment; agro-ecological zones of India.

**UNIT II**

Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.

**UNIT III**

Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

**UNIT IV**

Scientific principles of crop production; crop response, production and functions; concept of soil plant relations; yield and environmental stress.

**UNIT V**

Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of

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crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture.

**Suggested Readings:**

1. Balasubramaniyan P & Palaniappan SP. 2001. *Principles and Practices of Agronomy*. Agrobios.
2. Fageria NK. 1992. *Maximizing Crop Yields*. Marcel Dekker.
3. Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. 7<sup>th</sup> Ed. Prentice Hall.
4. Paroda R.S. 2003. *Sustaining our Food Security*. Konark Publ. Reddy SR. 2000. *Principles of Crop Production*. Kalyani Publ.
5. Sankaran S & Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ.

**Course outcome:**

After completing the course student will be able to acquire Basic knowledge on soil management and crop production

<b>MAGR-102: PRINCIPLE AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT</b>	
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<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures and Practical: 3 hr./ week (2+1)	Unit Test: 30Marks
Tutorials: Nil	Practical marks: 20Marks
Credits: 3	End Semester Exam:50Marks

**Course objective:**

1. To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.

**Theory:****UNIT I**

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

**UNIT II**

Criteria of essentiality of nutrients; Essential plant nutrients - their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

**UNIT III**

Preparation and use of farmyard manure, compost, green manures, vermin-compost, bio-fertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management.

**UNIT IV**

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

**UNIT V**

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

**Practical:**

1. Determination of soil pH, EC, organic C, total N, available N, P, K and S in soils
2. Determination of total N, P, K and S in plants
3. Interpretation of interaction effects and computation of economic and yield optima

**Suggested Readings:**

1. Brady NC & Weil R.R 2002. *The Nature and Properties of Soils*. 13<sup>th</sup> Ed. Pearson Edu.
2. Fageria NK, Baligar VC & Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops*. Marcel Dekker.
3. Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. 7<sup>th</sup> Ed. Prentice Hall.
4. Prasad R & Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.  
& BokdeS. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

**Course outcome:**

After completing the course student will be able to acquire Basic knowledge on soil fertility and management

<b>MAGR-103: PRINCIPLES AND PRACTICES OF WEED MANAGEMENT</b>	
<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures and Practical: 3 hr./ week (2+1)	Unit Test: 30Marks
Tutorials: Nil	Practical marks: 20Marks
Credits: 3	End Semester Exam:50Marks

**Course objective:**

1. To familiarize the students about the weeds, herbicides and methods of weed control.

**Theory:****UNIT I**

Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices.

**UNIT II**

Herbicide's introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.

**UNIT III**

Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation.

**UNIT IV**

Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control.

**UNIT V**

Integrated weed management; cost: benefit analysis of weed management.

**Practical:**



1. Identification of important weeds of different crops
2. Preparation of a weed herbarium
3. Weed survey in crops and cropping systems
4. Crop-weed competition studies
  
5. Preparation of spray solutions of herbicides for high and low-volume sprayers
6. Use of various types of spray pumps and nozzles and calculation of swath width
7. Economics of weed control
8. Herbicide resistance analysis in plant and soil
9. Bioassay of herbicide resistance
10. Calculation of herbicidal requirement

**Suggested Readings:**

1. Aldrich RJ & Kramer RJ. 1997. *Principles in Weed Management*. Panima Publ. Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2<sup>nd</sup> Ed. Wiley Inter-Science.
2. Gupta OP. 2007. *Weed Management – Principles and Practices*. Agrobios. Mandal RC. 1990. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro-Botanical Publ.
3. Rao VS. 2000. *Principles of Weed Science*. Oxford & IBH.
4. Subramanian S, Ali AM & Kumar RJ. 1997. *All About Weed Control*. Kalyani.
5. Zimdahl RL. 1999. *Fundamentals of Weed Science*. 2<sup>nd</sup> Ed. Academic Press.

**Course outcome:**

After completing the course student will be able to acquire basic knowledge on weed identification and control for crop production

<b>MAGR-104: PRINCIPLES AND PRACTICES OF WATER MANAGEMENT</b>	
<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures and Practical: 3 hr./ week (2+1)	Unit Test: 30Marks
Tutorials: Nil	Practical marks: 20Marks
Credits: 3	End Semester Exam:50Marks

**Course objective:**

1. To teach the principles of water management and practices to enhance the water use efficiency.

**Theory:****UNIT I**

Water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states.

**UNIT II**

Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition.

**UNIT III**

Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; micro irrigation system; fertigation; management of water in controlled environments and poly- houses.

**UNIT IV**

Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency.

**UNIT V**

Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing.

**Practical:**

1. Measurement of soil water potential by using tensiometer, and pressure plate and membrane apparatus
2. Soil-moisture characteristics curves
3. Water flow measurements using different devices
4. Determination of irrigation requirements
5. Calculation of irrigation efficiency
6. Determination of infiltration rate
7. Determination of saturated/unsaturated hydraulic conductivity.

**Suggested Readings:**

1. Lenka D. 1999. *Irrigation and Drainage*. Kalyani
2. Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.
3. Paliwal KV. 1972. *Irrigation with Saline Water*. IARI Monograph, New Delhi.
4. Panda SC. 2003. *Principles and Practices of Water Management*. Agrobios.
5. Prihar SS & Sandhu BS. 1987. *Irrigation of Food Crops - Principles and Practices*. ICAR.
6. Reddy SR. 2000. *Principles of Crop Production*. Kalyani.

**Course outcome:**

After completing the course student will be able to acquire Basic knowledge on water management for optimization of crop yield.

<b>MAGR-105 EXPERIMENTAL DESIGN</b>	
<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures and Practical: 3 hr./ week (2+1)	Unit Test: 30Marks
Tutorials: Nil	Practical marks: 20Marks
Credits: 3	End Semester Exam:50Marks

**Course Objectives:**

This course is meant for students of agricultural and animal sciences other than Agricultural Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

**Theory:****UNIT I**

Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control.

**UNIT II**

Uniformity trials, size and shape of plots and blocks, Analysis of variance, Completely randomized design, randomized block design and Latin square design.

**UNIT III**

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom. Concept of confounding.

**UNIT IV**

Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Combined

analysis.

### **Practical**

1. Uniformity trial data analysis,
2. formation of plots and blocks,
3. Fairfield Smith Law,
4. Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments, Analysis with missing data, Split plot and strip plot designs.

### ***Suggested Reading***

1. Cochran WG and Cox GM. 1957. *Experimental Designs*. 2<sup>nd</sup> Ed. John Wiley.
2. Dean AM and Voss D. 1999. *Design and Analysis of Experiments*. Springer.
3. Montgomery DC. 2012. *Design and Analysis of Experiments*, 8<sup>th</sup> Ed. John Wiley.
4. Federer WT. 1985. *Experimental Designs*. MacMillan.
5. Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.
6. Nigam AK and Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
7. Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory*

*and Practice*. John Wiley.

### **Course outcome:**

After completing the course student will be able to acquire and apply regression and other statistical methods to analyze field data and Gain proficiency in using statistical software for data analysis.

<b>MAGR-106: BASIC CONCEPTS IN LABORATORY TECHNIQUES</b>	
<b>Teaching Scheme</b> Lectures and Practical: 1 hr./ week (0+1) Tutorials: Nil Credits: 1	<b>Examination Scheme</b> Practical marks: 100 Marks

**Course objective:**

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

**Practical:**

1. Safety measures while in Lab;
2. Handling of chemical substances;
3. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers micropipettes and vaccumets;
4. Washing, drying and sterilization of glassware;
5. Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution;
6. Handling techniques of solutions;
7. Preparation of different agro-chemical doses in field and pot applications;
8. Preparation of solutions of acids; Neutralization of acid and bases;
9. Preparation of buffers of different strengths and pH values.
10. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath;

11. Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability;

12. Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

**Suggested Readings:**

1. Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.
2. Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co. Sage Publ.
3. Punia MS. *Manual on International Research and Research Ethics*. CCS, Haryana Agricultural University, Hisar.
4. Rao BSV. 2007. *Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives*. Mittal Publ.
5. Singh K. 1998. *Rural Development - Principles, Policies and Management*. Sage Publ.

**Course outcome:**

After completing the course, the student will be able to perform laboratory activities such as washing, drawing and sterilization of glass ware, drawing of solvents /chemicals and carry out experiments following best laboratory practices.

**MAGR-107: LIBRARY AND INFORMATION SERVICES**

<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures and Practical: 1 hr./ week (0+1) Tutorials: Nil Credits: 1	Practical marks: 100 Marks

**Course objective:**

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

**Practical:**

1. Introduction to library and its services;
2. Role of libraries in education, research and technology transfer;
3. 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.);
4. Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography;
5. Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services;
6. Use of Internet including search engines and its resources;



7. e-resources access methods.

**Course outcome:** after completing the course, student will be able to formulate search strategy and use modern tools for gathering desired information/data required, using best ethical practices.





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**of**

**M.Sc. Ag. (Agronomy)**

**Course Curriculum**

*(w.e.f. Academic Session 2022-2023)*

**Department of Agriculture**

**INVERTIS UNIVERSITY- INVERTIS VILLAGE**

**Bareilly- Lucknow NH-24, Bareilly**

## Examination Scheme (Second Semester)

<b>II Semester (Credit hours distribution)</b>			
<b>S.No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	MAGR-201	Agronomy of major Cereals and Pulses	2(2+0)
2	MAGR 202	Principles and Practices of Organic Farming	3(2+1)
3	MAGR-203	Basic Sampling Techniques	3(2+1)
4	MAGR-204	Soil Fertility and Plant nutrition	3(2+1)
5	MAGR-205	Agricultural Research, Research Ethics and Rural Development Programmers'	1(1+0)*
6	MAGR- 206	Intellectual Property and its Management in Agriculture	1(1+0)*
7	MAGR-460	Master's Research	6(0+6)*
		<b>Total Credit</b>	<b>19 ((8+2*))+3+6*)</b>
*-Non gradial, ((8+2*))+3+6*):-10 lectures,(8 Main course+2 Non gradial course) 9 practical's (3Main practicals+6 Non gradial practical's)			

<b>Evaluation Scheme</b>									
<b>Course code</b>	<b>Course title</b>	<b>C</b>	<b>L</b>	<b>P</b>	<b>PM</b>	<b>UT</b>	<b>ESM</b>	<b>T</b>	<b>MP</b>
MAGR-201	Agronomy of major Cereals and Pulses	2	2	0	20	30	50	100	10.0
MAGR-202	Principles and Practices of Organic Farming	3	2	1	20	30	50	100	10.0
MAGR-203	Basic Sampling Techniques	3	2	1	20	30	50	100	10.0
MAGR-204	Soil Fertility and Plant Nutrition	3	2	1	20	30	50	100	10.0
MAGR- 205	Agricultural Research, Research Ethics and Rural Development Programmes*	1	1	0	-	50	50	100	S
MAGR-206	Intellectual Property and its Management in Agriculture*	1	1	0	-	50	50	100	S
MAGR-460	Masters' Research*	6	0	6	-	-	-	-	S
C-Credit, L-Lecture, P-Practical, UT-Unit test, ESM: End semester marks, MP: Maximum Points, S: Satisfactory									

<b>MAGR - 201: AGRONOMY OF MAJOR CEREALS AND PULSES</b>	
<b>Teaching Scheme</b> Lectures and Practical: 2 hr./ week (2+0) Tutorials: Nil Credits: 2	<b>Examination Scheme</b> Unit test:50 End Semester Exam: 50 Marks

**Course objective:**

1. To teach the crop husbandry of cereals and pulse crops.

**Theory:****UNIT I**

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality components, handling and processing of the produce for maximum production of crops *Rabi* cereals: Wheat, Barley and Oat

**UNIT II**

*Kharif* cereals: Rice, Maize, Sorghum, Pearl millet and Minor millet

**UNIT III**

*Rabi* pulses: Chickpea, pea, Lentil and Rajmash

**UNIT IV**

*Kharif* pulses: Arhar, Green gram, Black gram and Cowpea

**UNIT V**

*Zaid* crops: Urd and Moong

**Suggested Readings:**

1. Das NR. 2007. *Introduction to Crops of India*. Scientific Publ.
2. Hunsigi G & Krishna KR. 1998. *Science of Field Crop Production*. Oxford & IBH.
3. Jeswani LM & Baldev B. 1997. *Advances in Pulse Production Technology*. ICAR.
4. Khare D & Bhale MS. 2000. *Seed Technology*. Scientific Publ.

5. Kumar Ranjeet & Singh NP. 2003. *Maize Production in India: Golden Grain in Transition*.
6. Pal M, Deka J & Rai RK. 1996. *Fundamentals of Cereal Crop Production*. Tata McGraw Hill.
7. Prasad, Rajendra. 2002. *Text Book of Field Crop Production*. ICAR.  
Singh C, Singh P & Singh R. 2003. *Modern Techniques of Raising Field Crops*. Oxford & IBH.
8. Singh SS. 1998. *Crop Management*. Kalyani. Yadav DS. 1992. *Pulse Crops*. Kalyani.

**Course outcome:**

After completing the course student will be able to acquire Basic knowledge on cereals and pulse growing in the country.

<b>MAGR- 202: PRINCIPLES AND PRACTICES OF ORGANIC FARMING</b>	
<b>Teaching Scheme</b> Lectures and Practical: 3 hr./ week (2+1) Tutorials: Nil Credits: 3	<b>Examination Scheme</b> Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

**Course objective:**

- 1.To study the principles and practices of organic farming for sustainable crop production.

**Theory:****UNIT I**

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.

**UNIT II-**

Organic farming and water use efficiency; soil fertility, nutrient recycling , organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

**UNIT III**

Farming systems, crop rotations, multiple and relay cropping systems intercropping in relation to maintenance of soil productivity.

**UNIT IV**

Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides.

**UNIT V**

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

**Practical:**

- 1.Aerobic and anaerobic methods of making compost.
- 2.Making of vermicompost
- 3.Identification and nursery raising of important agro-forestry trees and trees for shelterbelts
- 4.Efficient use of biofertilizers, technique of treating legume seeds with *Rhizobium* cultures, use of *Azotobacter*, *Azospirillum*, and PSB cultures in field
- 5.Visit to an organic farm.

6. Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms.

**Suggested Readings:**

1. Ananthakrishnan TN. (Ed.). 1992. *Emerging Trends in Biological Control of Phytophagous Insects*. Oxford & IBH.
2. Gaur AC. 1982. *A Manual of Rural Composting*, FAO/UNDP Regional Project Document, FAO.
3. Lampin N. 1990. *Organic Farming*. Press Books, Ipswich, UK. Palaniappan SP & Anandurai K. 1999. *Organic Farming – Theory and Practice*. Scientific Publ.
4. Rao BV Venkata. 1995. *Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3, Parisaraprajna Parishtana, Bangalore.*
5. Reddy MV. (Ed.). 1995. *Soil Organisms and Litter Decomposition in the Tropics*. Oxford & IBH.
6. Sharma A. 2002. *Hand Book of Organic Farming*. Agrobios.
7. Singh SP. (Ed.) 1994. *Technology for Production of Natural Enemies*. PDBC, Bangalore.
8. Subba Rao NS. 2002. *Soil Microbiology*. Oxford & IBH.
9. Trivedi RN. 1993. *A Text Book of Environmental Sciences*, Anmol Publ.

**Course outcome:**

After completing the course student will be able to acquire Basic knowledge on organic farming for sustainable agriculture and development



<b>MAGR -203: BASIC SAMPALING TECHNIQUES</b>	
<b>Teaching Scheme</b> Lectures and Practical: 3 hr./ week (2+1) Tutorials: Nil Credits: 3	<b>Examination Scheme</b> Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

**Course objective:**

This course is meant for students of agricultural and animal sciences other than Statistics. The students would be exposed to elementary sampling techniques. It would help them in understanding the concepts involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results. This course would be especially important to the students of social sciences.

**Theory:****UNIT I**

Concept of sampling, sample survey vs complete enumeration, planning of sample survey, sampling from a finite population.

**UNIT II**

Simple random sampling with and without replacement, sampling for proportion, determination of sample size, inverse sampling, Stratified sampling.

**UNIT III**

Cluster sampling, Multi-stage sampling, systematic sampling; Introduction to PPS sampling,

**UNIT IV**

Use of auxiliary information at estimation, Ratio product and regression estimators. Double Sampling, sampling and non-sampling error

**Practical:**

1. Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.
2. Simple random sampling, determination of sample size, inverse sampling, stratified sampling, cluster sampling and systematic sampling.
3. Estimation using ratio and regression estimators.
4. Estimation using multistage design, double sampling.

**Suggested Reading:**

1. Cochran WG. 1977. *Sampling Techniques*. John Wiley.
2. Murthy MN. 1977. *Sampling Theory and Methods*. 2<sup>nd</sup> Ed. Statistical Publ. Soc., Calcutta.
3. Singh D, Singh P and Kumar P. 1982. *Handbook on Sampling*

*Methods. IASRI Publ.*

4. Sukhatme PV, Sukhatme BV, Sukhatme S and Asok C. 1984.  
*Sampling Theory of Surveys with Applications*. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.
5. Cochran WG. 2007. *Sampling Techniques*, 3<sup>rd</sup> Edition. John Wiley & Sons Publication

<b>MAGR -204: SOIL FERTILITY AND PLANT NUTRITION</b>	
<b>Teaching Scheme</b> Lectures and Practical: 3 hr./ week (2+1) Tutorials: Nil Credits: 3	<b>Examination Scheme</b> Unit Test: 30Marks Practical marks: 20Marks End Semester Exam:50Marks

**Course objective:**

1.To teach basics of soil fertility evaluation, techniques of soil fertility evaluation, plant nutrients, integrated approach of plant nutrition, and environmental quality.

**UNIT II**

Soil fertility concept. Factor effecting of soil fertility. Essential and beneficial elements.

**UNIT II**

Nutrient deficiencies and toxicities-recent diagnostic techniques and ameliorative measures.

**UNIT III**

Nutrient and nutrient water interaction. Balanced use of nutrients. Integrated plant nutrient supply and management.

**UNIT IV**

Nutrient Uptake mechanisms, nutrient release and carry-over effects, quantity-intensity relationship.

**UNIT V**

Soil fertility evaluation, soil test crop response correlations.

**Practical:**

1. Laboratory and greenhouse experiments for evaluation of indices of nutrient availability and their critical value in soil and plant.
2. Determination of different pools of macro and micro nutrients. Quantity-intensity relation of P and Decomposition of organic matter in Soil enzymes
3. Measurement of important soil microbial processes such as ammonification, nitrification, N<sub>2</sub> fixation, S oxidation, P solubilization and mineralization of other micro nutrients Study of rhizosphere effect

**Suggested Readings:**

1. Alexander M. 1977. *Introduction to Soil Microbiology*. John Wiley & Sons.
2. Burges A & Raw F. 1967. *Soil Biology*. Academic Press.
3. McLaren AD & Peterson GH. 1967. *Soil Biochemistry*. Vol. XI. Marcel Dekker.
4. Metting FB. 1993. *Soil Microbial Ecology – Applications in Agricultural and Environmental Management*. Marcel Dekker.
5. Paul EA & Ladd JN. 1981. *Soil Biochemistry*. Marcel Dekker.
6. Reddy MV. (Ed.). *Soil Organisms and Litter in the Tropics*. Oxford & IBH.

**Course outcome:**

After completing the course student will be able to acquire Soil fertility concept. Factor effecting of soil fertility. And knowledge Essential and beneficial elements.

<b>MAGR-205: AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES</b>	
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<b>Teaching Scheme</b>	<b>Examination Scheme</b>
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Lectures and Practical: 1 hr./ week (1+0)	Unit test:50
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Tutorials: Nil	End Semester Exam: 50 Marks
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Credits: 1	
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**Course objective:**

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

**Theory:****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; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

**UNIT II**

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

**UNIT III**

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

**Suggested Readings:**

1. Bhalla GS & Singh G. 2001. *Indian Agriculture - Four Decades of Development*

**Course outcome:** after completing the course student will be able to understand the functioning of research system in India and abroad, they will also be able to follow research ethics and have knowledge about various rural development programs and policies of govt.

<b>MAGR-206: INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE</b>	
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**Teaching Scheme**

Lectures and Practical: 1 hr./ week (1+0)

Tutorials: Nil

Credits: 1

**Examination Scheme**

Theory marks: 50Marks

End Semester Exam:50Marks

**Course objective:**

The main objective of this course is to equip students 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.

**Theory:****UNIT I**

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement;

**UNIT II**

Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties;

**UNIT III**

Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and bio-diversity protection;

**UNIT IV**

Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives;

**UNIT V**

Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture;

**UNIT VI**

Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

**Suggested Readings:**

1. Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural *Biotechnology*. CABI.93.
2. Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.
3. *Intellectual Property Rights: Key to New Wealth Generation. 2001*. NRDC & Aesthetic Technologies. Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer. Vol.V. Technology Generation and IPR Issues*. Academic Foundation.
4. Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI.
  
5. Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House. *The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000;*
6. *Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.*

**Course outcome:** after completing the course student will be able to have understanding of intellectual property rights, their importance and protection methods, Students will also be able to use IPR as a tool for value and wealth creation



