Course Curriculum of PG Programme

(Major, Minor, Supporting and Non-credit courses)

MASTER OF SCIENCE IN AGRONOMY

SEMESTER-II

SHRI VAISHNAV INSTITUTE OF AGRICULTURE, INDORE

SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE

SYLLABUS

MASTER OF SCIENCE IN AGRONOMY

SEMESTER-II

COURSE CODE	COURSE TITLE	CREDITS
MAJOR		
AGRON 502	Principles And Practices of Soil Fertility and Nutrient Management	2+1
AGRON 503	Principles And Practices of Weed Management	2+1
AGRON 511	Cropping system and Sustainable Agriculture	2+0
MINOR		
GPB 512	Plant Breeding – II (*Rabi* Crops)	2+1
SUPPORTING		
STAT 511	Experimental designs	2+1
NON-CREDIT		
*PGS 504	Basic Concept in Laboratory Techniques	0+1
*PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0

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Shri Vaishnav Institute of Agriculture
M.Sc. (Ag.) Agronomy

Course Code	Course Name	TEACHING & EVALUATION SCHEME							
		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
AGRON 502	Principles and Practices of Soil Fertility and Nutrient Management	50	30	00	15	05	2	1	3

1. Legends: L - Lecture**; P –** Practical
**2. ***Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

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

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, vermicompost, biofertilizers and other organic concentrates theircomposition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation.

UNIT IV

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

UNIT V

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

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

Suggested Readings

1. Brady NC & Weil R.R 2002. *The Nature and Properties of Soils.* 13th Ed. Pearson Edu.
2. Fageria NK, Baligar VC & Jones CA. 1991. *Growth and Mineral Nutritionof Field Crops.* Marcel Dekker.
3. Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility andFertilizers.* 7th Ed. Prentice Hall.
4. Prasad R & Power JF. 1997. *Soil Fertility Management for SustainableAgriculture*. CRC Press.
5. Yawalkar KS, Agrawal JP & Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

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		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
AGRON 503	Principles and Practices of Weed Management	50	30	00	15	05	2	1	3

1. Legends: L - Lecture**; P –** Practical

**2. ***Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

To familiarize the students about the weeds, herbicides and methods ofweed control.

Theory

UNIT I

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

UNIT II

Herbicides 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, sequential application of herbicides, rotation; weed control through use of nano-herbicides and bio-herbicides, 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.

UNIT IV

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.

UNIT V

Integrated weed management; recent development in weed management- robotics, use of drones and aeroplanes, organic etc., cost: benefit analysis of weed management.

Practical

- Identification of important weeds of different crops
- Preparation of a weed herbarium
- Weed survey in crops and cropping systems
- Weed indices calculation and interpretation with data
- Crop-weed competition studies
- Preparation of spray solutions of herbicides for high and low-volume sprayers
- Use of various types of spray pumps and nozzles and calculation of swath width
- Economics of weed control
- Herbicide resistance analysis in plant and soil

- Bioassay of herbicide resistance
- Calculation of herbicidal requirement

Suggested Readings

1. Aldrich RJ & Kramer RJ. 1997. *Principles in Weed Management*. PanimaPubl.
2. Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2nd Ed. Wiley Inter-Science.
3. Chauhan B and Mahajan G. 2014. *Recent Advances in Weed Management*. Springe
4. Das TK. 2008. *Weed Science: Basics and Applications,* Jain Brothers (New Delhi).
5. Gupta OP. 2007. *Weed Management – Principles and Practices.* Agrobios. Mandal RC. 1990. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro-Botanical Publ.
6. Rao VS. 2000. *Principles of Weed Science*. Oxford & IBH.
7. Subramanian S, Ali AM & Kumar RJ. 1997. *All About Weed Control*. Kalyani.
8. Walia US. 2006. *Weed Management,* Kalyani
9. Zimdahl RL. 2018. *Integrated Weed Management for Sustainable Agriculture,* B. D. Sci. Pub.

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		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
AGRON 511	Cropping Systems and Sustainable Agriculture	50	40	10	00	00	2	0	2

1. Legends: L - Lecture**; P –** Practical
**2. ***Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective
To acquaint the students about prevailing cropping systems in the countryand practices to improve their productivity.

Theory
UNIT I
Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.
UNIT II
Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping,mechanism of yield advantage in intercropping systems.
UNIT III
Above and below ground interactions and Allelopathy 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.
UNIT IV
Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Advanced nutritional tools for big data analysis and interpretation.
UNIT V
Plant ideotype for Dryland; plant growth regulators and their role in sustainability. Artificial Intelligence- Concept and application.

Suggested Readings

1. Panda SC. 2017. *Cropping Systems and Sustainable Agriculture*. Agrobios (India)
2. Panda SC. 2018. *Cropping and Farming Systems*. Agrobios.
3. Palaniappan SP and Sivaraman K. 1996. *Cropping Systems in the Tropics; Principles and Management*. New Age.
4. Panda SC. 2003. *Cropping and Farming Systems*. Agrobios.
5. Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
6. Sankaran S and Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ. Co.
7. Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
8. Tisdale SL, Nelson WL, Beaton JD and Havlin JL. 1997. *Soil Fertility and Fertilizers*. Prentice Hall.

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		THEORY			PRACTICAL		L	P	CREDITS
		End Sem University Exam	Mid Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*			
GPB 512	Crop Breeding-II (*Rabi* Crops)	50	30	0	15	5	2	1	3

1. Legends: L - Lecture; **P** – Practical;

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class etc.

Objective

To provide insight into recent advances in improvement of Rabi cereals, legumes, oilseeds, fibre and vegetative propagated crops using conventional and modern biotechnological approaches.

Theory

UNIT I

Wheat: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.

Oats: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.

Barley: Origin, evolution, center of origin, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement

UNIT II

Chickpea: Origin, evolution mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.

Other pulses: Lentil, field pea, Rajma, Horse gram: Origin, evolution, mode of reproduction, chromosome number; Genetics. cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement. Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them.

UNIT III

Rapeseed and Mustard: Origin, evolution, mode of reproduction, chromosome number;

Genetics – cytogenetics and genome relationship; Breeding objectives; yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Oil quality, Improvement for oil quality.
Sunflower, Safflower: Origin, mode of reproduction, chromosome number; Genetics, cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement

UNIT IV

Mesta and minor fibre crops: Origin, mode of reproduction, chromosome number, Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.
Forage crops: Origin, evolution mode of reproduction, chromosome number; Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance

UNIT V

Seed spices: Origin, evolution, mode of reproduction, chromosome number; Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, scope of heterosis breeding, released varieties, examples of MAS used for crop improvement.

Practical

- Floral biology, emasculation and pollination techniques in wheat, oats, barley, chickpea, rajma, rapeseed mustard, sunflower.
- Study of range of variation for yield and yield components.
- Study of segregating populations in cereal, pulses and oilseed crops.
- Use of descriptors for cataloguing; Learning on the crosses between different species.
- Trait based screening for stress resistance.
- Learning on the Standard Evaluation System (SES) and descriptors.
- Use of software for database management and retrieval

Suggested Readings

1. Agarwal RL. 1996. Identifying Characteristics of Crop Varieties. Oxford & IBH.
2. Bahl PN and Salimath PM. 1996. Genetics, Cytogenetics and Breeding of Crop Plants. Vol. I. Pulses and Oilseeds. Oxford & IBH.
3. Gupta SK. 2012. Technological Innovations in Major World Oil crops. Vol. I. Springer, USA.
4. Gupta SK. 2012. Technological Innovations in Major World Oil crops. Vol. II. Springer, USA.
5. Gupta SK. 2016. Breeding of Oilseed Crops for Sustainable Production. Academic Press, USA.
6. Kannaiyan S, Uthamasamy S, Theodore RK and Palaniswamy S. 2002. New Dimensions and Approaches for Sustainable Agriculture. Directorate of Extension Education, TNAU, Coimbatore.
7. Parthasarathy VA. 2017. Spices and Plantation Crops Vol.1 (Part A) Breeding of Breeding and Genetics. John Wiley & Sons.

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		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
STAT 511	Experimental Designs	50	30	00	15	05	2	1	3

1. Legends: L - Lecture**; P –** Practical
**2. ***Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

This course is meant for students of agricultural and animal sciences other than 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, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment.

UNIT IV

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.

UNIT V

Bioassays- direct and indirect, indirect assays based on quantal doseresponse, parallel line and slope ratio assays potency estimation.

Practical

- Uniformity trial data analysis, formation of plots and blocks, FairfieldSmith Law

- Analysis of data obtained from CRD, RBD, LSD.
- Analysis of factorial experiments without and with confounding
- Analysis with missing data
- Split plot and strip plot designs
- Transformation of data
- Analysis of resolvable design
- Fitting of response surfaces.

Suggested Readings

1. Cochran WG & Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley.
2. Dean AM & Voss D. 1999. *Design and Analysis of Experiments*. Springer.
3. Federer WT. 1985. *Experimental Designs*. MacMillan.
4. Fisher RA. 1953. *Design and Analysis of Experiments*.
5. Oliver & Boyd. Nigam AK & Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
6. Pearce SC. 1983. *The Agricultural Field Experiment: A StatisticalExamination of Theory and Practice*. John Wiley.
7. Design Resources Server: www.iasri.res.in/design.

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		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
PGS 504	Basic Concept in Laboratory Techniques	00	00	00	60	40	0	1	1

1. Legends: L - Lecture**; P –** Practical

**2. ***Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

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

Practical

- Safety measures while in Lab.
- Handling of chemical substances;
- Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets;
- Washing, drying and sterilization of glassware.
- Drying of solvents/ chemicals.
- Weighing and preparation of solutions of different strengths and their dilution; • Handling techniques of solutions.
- Preparation of different agro-chemical doses in field and pot applications.
- Preparation of solutions of acids.
- Neutralisation of acid and bases.
- Preparation of buffers of different strengths and pH values.
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath;
- Electric wiring and earthing;
- Preparation of media and methods of sterilization.
- Seed viability testing, testing of pollen viability.
- Tissue culture of crop plants.
- Description of flowering plants in botanical terms in relation to taxonomy.

Suggested Readings

1. Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press
2. Gabb MH and Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

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		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	50	40	10	00	00	1	0	1

1. Legends: L - Lecture**; P –** Practical

**2. ***Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

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

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,

UNIT IV

Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP), Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations.

UNIT V

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. Sage Publ.

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