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 – I (*Rabi* Crops)	2+1
SUPPORTING		
STAT 502	Statistical Methods for Applied Sciences	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

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
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 Nutrition of Field Crops.* Marcel Dekker.
3. Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers.* 7th Ed. Prentice Hall.
4. Prasad R & Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.
5. Yawalkar KS, Agrawal JP & Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

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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 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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STAT 511	Statistical Methods for Applied Sciences	50	30	00	15	05	3	1	4

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 who do not have sufficient background of Statistical Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance,regression and multivariate analytical techniques.

Theory

UNIT I

Classification, tabulation and graphical representation of data. Box-plot, Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation.

UNIT II

Discrete and continuous probability distributions: Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions andtheir applications. Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions. Large sample theory.

UNIT III

Introduction to theory of estimation and confidence-intervals. Correlation and regression. Simple and multiple linear regression model, estimation of parameters, predicted values and residuals, correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, test of significance of correlation coefficient and regression coefficients. Coefficient of determination. Polynomial regression models and their fitting. Probit regression analysis by least squares and maximum likelihood methods, confidence interval for sensitivity; Testing for heterogeneity.

UNIT IV

Non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run

test for the randomness of a sequence. Median test, Kruskal- Wallis test, Friedman two-way ANOVA by ranks. Kendall's coefficient of concordance.

UNIT V

Introduction to multivariate analytical tools- Hotelling's T^2 Tests ofhypothesis about the mean vector of a multinormal population. Classificatory problems and discriminant function, D^2-statistic and its applications; Cluster analysis, principal component analysis, canonical correlations and Factor analysis.

Practical

- Exploratory data analysis, Box-Cox plots.
- Fitting of distributions ~ Binomial, Poisson, Negative Binomial, Normal.
- Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F.
- Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution.
- Correlation and regression analysis, fitting of orthogonal polynomial regression.
- Applications of dimensionality reduction and discriminant function analysis; non-parametric tests.

Suggested Readings

1. Anderson TW. 1958. *An Introduction to Multivariate Statistical Analysis*. John Wiley.
2. Dillon WR & Goldstein M. 1984. *Multivariate Analysis - Methods and Applications*. John Wiley.
3. Goon AM, Gupta MK & Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press.
4. Goon AM, Gupta MK & Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.
5. Hoel PG. 1971. *Introduction to Mathematical Statistics*. John Wiley.
6. Hogg RV & Craig TT. 1978. *Introduction to Mathematical Statistics*. Macmillan.
7. Morrison DF. 1976. *Multivariate Statistical Methods*. McGraw Hill.
8. Siegel S, Johan N & Casellan Jr. 1956. *Non-parametric Tests for Behavior Sciences*. John Wiley.
9. Learning Statistics: http://freestatistics.altervista.org/en/learning.php. Electronic Statistics Text Book: http://www.statsoft.com/textbook/stathome.html.

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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
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.