MAA Pateswari University, Balarampur,

To,

Date: 29/08/2025

The Registrar,

MAA Pateswari University, Balarampur, U.P

Subject: Discussion on approval of unified syllabus of Agriculture regarding to ICAR Rule.

Respected Sir,

The virtual meeting of Board of Studies (BOS) was organized on 09/04/2025, 20/06/2025 31/07/2025, 01/08/2025 and 17/08/2025 for preparing the unified syllabus of PG (Two Year) with respect to ICAR guidelines.

Following members participated in the discussion.

Sr .No.	Name of Expert/BOS Member	Designation	Department	College/ University
1.	Dr. Rekha Sharma	Convener	Department of Botany	S.L.B.S. Degree College, Gonda
2.	Dr. Shiv Mahendra Singh	Member	Department of Botany	M.L.K P. G College, Balrampur
3.	Dr. Deepak Kumar Singh	Member	Department of Botany	A.N.D Kisan P.G College, Babhnan, Gonda
4.	Prof. Anil Kumar Dwivedi	Member	Department of Botany	D. D. U University, Gorakhpur
5.	Prof. N.K Singh *(Ret. Principal)*	Member	Department of Botany	M.L.K P. G College, Balrampur
6	Dr. Ashutosh Kumar Verma	Member	Department of Botany	Siddharth University, Kapilvastu, Siddharth Nagar

After discussion and amendment, the committee reached on a common platform. The unanimously accepted unified syllabus is enclosed as pdf for your kind approval.

With Regards

Rekha

Dr. Rekha Sharma (Convener)

Department of Botany

S.L.B.S. Degree College, Gonda

MAA Pateswari University, Balarampur,

P.G. AGRICULTURE SYLLABUS

FACULTY OF AGRICULTURE

MAA Pateswari University, Balarampur, U.P

Syllabus Developed/Proposed by				
Sr.No.	Name of Expert/BOS Member	Designation	Department	College/ University
1.	Dr. Rekha Sharma	Convener	Department of Botany	S.L.B.S. Degree College, Gonda
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6	Dr. Ashutosh Kumar Verma	Member	Department of Botany	Siddharth University, Kapilvastu, Siddharth Nagar

Dr. Rekha Sharma (Convener)

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Dr. Ashutosh Kumar Verma

MAA Pateswari University, Balarampur,

Maa Pateswari University, Balrampur, (U. P.) India

Semester-wise distribution of M.Sc. (Ag.) courses

M.Sc. (AG) Genetics and Plant Breeding

I Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
GPB 501	Principles of Genetics	3(2+1)	20	50	30	100
GPB 502	Principles of Cytogenetics	3(2+1)	20	50	30	100
GPB 503	Principles of Plant Breeding	3(2+1)	20	50	30	100
AS 501	Agricultural Statistics	3(3+1)	20	50	30	100
TOTAL CREDIT		**12**				

II Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
GPB 504	Principle of quantitative genetics	3(2+1)	20	50	30	100
GPB 508	Cell biology and molecular genetics	3(2+1)	20	50	30	100
PGS 501	Library and information service (Non gradial Satisfactory)	1(0+1)	00	00	100	100
PGS 502	Technical writing and communication skill (Non gradial Satisfactory)	1(0+1)	00	00	100	100
PGS 503	Intellectual property rights and its management in agriculture (Non gradial Satisfactory)	1(1+0)	40	60	00	100
TOTAL CREDIT		**09**				

MAA Pateswari University, Balarampur,

III Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
GPB 506	Biotechnology for crop improvement	3(2+1)	20	50	30	100
GPB 507	Breeding for biotic and abiotic stress resistance	3(2+1)	20	50	30	100
GPB 505	Maintenance breeding concept of variety release and seed production	3(2+1)	20	50	30	100
CA 502	Computer Application in Agriculture	2(1+1)	20	50	30	100
PGS 504	Basic concepts in laboratory technique (Non gradial Satisfactory)	1(0+1)	00	00	100	100
PGS 505	Agricultural research, research ethics and rural development programmes (Non gradial Satisfactory)	2(2+0)	40	60	00	100
PGS 506	Disaster management (Non gradial Satisfactory)	1(1+0)	40	60	00	100
TOTAL CREDIT		**15**				

IV-Semester

Code No.	Course Title	Credit Hours	
GPB-591	Master Seminar	1(0+1)	**Presentation**
GPB-599	Master Research (Thesis)	20	**Research**

OR
Special Paper (20 Credits) Satisfactory/ Unsatisfactory

			Evaluation marks			
Code No.	Course Title	Credit Hours	Mid Term	Theory	Practical	Total
GPB -509	Breeding for quality traits	4(3+1)	20	50	30	100
GPB -510	Gene regulation and expression	4(4+0)	40	60	00	100
GPB -511	Database management, evaluation and utilization of PGR	4(3+1)	20	50	30	100
GPB -512	Germplasm collection, exchange, quarantine	4(3+1)	20	50	30	100
GPB -513	Breeding Legumes, Oilseeds and Fiber Crops	4(3+1)	20	50	30	100
		20				

Note- Passing marks in particular paper is 55%
Grade = Marks obtained in particular course divided by 10
The minimum grade point average (GPA) must be 5.5 in every semester
Pass : **5.5-5.99**
Second Division : **6.0-6.99**
First Division :**7.0-7.99**
First division with distinction : **8.0 and above**

MAA Pateswari University, Balarampur,

I Semester

DEPARTMENT OF GENETICS AND PLANT BREEDING M.Sc. (Ag.)

GP-501 PRINCIPLES OF GENETICS 3(2+1)

Theory:

UNIT I Beginning of genetics: Cell structure and cell division Mendel's law Discussion on Mendel's paper, Chromosomal theory of inheritance.

UNIT II Multiple alleles, Gene interaction, Sex determination. Sex linkage. Sex influenced and Sex-limited traits, Linkage-detection, estimation. Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance.

UNIT III Structural and numerical changes in chromosomes, Nature, Structure and replication of the genetic, material Organization of DNA in chromosomes, Genetic code.

UNIT IV Classical and modern gene concept. Genetic fine structure analysis, Allele complementation. Split genes, Transposable genetic elements, Overlapping genes. Pseudogene, Oncogenes, Gene families and clusters.

UNIT V Molecular mechanisms of mutation, repair and suppression Bacterial plasmid, Gene expression, Gene regulation in eukaryotes, RNA editing.

UNIT VI Gene isolation, synthesis and cloning, genomics and C-DNA libraries, PCR based cloning positional cloning: Nucleic acid Hybridization: DNA sequencing: DNA restriction and modification, Antisense RNA and ribozymes Micro RNAs (miRNAS).

UNIT VII Concept of Eugenics, Epigenetic, Genetic disorder and Behavioral genetics.

Practical:

Laboratory exercise in probability and chi-square. Demonstration of genetic principles using laboratory organisms: Numerical exercise related to Mendelian Principles, Numerical related to multiple allele (ABO Blood Group System) Chromosome mapping using three-point test cross Tetrad Analysis Induction and detection of mutation through genetic tests. Practical demonstrations-Detection transgene in the exposed plant material: visits to transgenic glass house and learning the practical considerations.

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GP-502- PRINCIPLES OF CYTOGENETICS 3(2+1)

Theory:

UNIT I Architecture chromosome: Chromonemata, chromosome matrix, chromomere, centromere, secondary constriction and telomere: Artificial chromosomes construction and its uses: Special types of chromosomes.

UNIT II Cell cycle and Cell Division: mitosis and meiosis Differences, significance and deviation-Synapsis, structure and function of synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over mechanism and theories of crossing over-recombination models cytological basis- Variation for karyotyping: Chromosome banding and Painting-in situ hybridization and various applications.

UNIT III Structural and numerical variations of chromosomes and their implication symbols and terminologies for chromosome numbers-euploidy-haploids and polyploids: utilization of aneuploids in gene location. evolutionary significance of chromosomal aberrations, balanced, lethal and chromosome complexes.

UNIT IV Inter varietal chromosome substitutions, Polyploidy and role of polyploidy in crop breeding Evolutionary advantages of autopolyploid vs allopolyploids Role of aneuploids in basis and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer -Alien addition and substitution lines creation and utilization. Apomixis Evolutionary and genetic problems in crops with apomixis.

UNIT V Reversion of autopolyploids to diploids Genome mapping in polyploids Interspecific hybridization and allopolyploids: Synthesis of new crops (wheat triticale and brassica)-Hybrids between species with same chromosome number: Gene transfer using amphidiploids-Bridge species.

UNIT VI Fertilization barriers in crop plants at pre and post fertilization levels-in vitro techniques to overcome the fertilization barriers in crops. Chromosome manipulations in wide hybridization, case studies-production and use of haploids. dihaploids double haploids in genetics and breeding.

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Practical:

Learning the cytogenetics various chemicals to be used for fixation, dehydration. Embedding, stunning, cleaning etc. Microscopy: Various types of microscopes Observing section of specimen using microscope Preparing specimen for observation Fixative preparations and fixing specimen for light microscopy studies in cereals. Studies on the courses of mitosis in wheat, pearl millet Studies on the courses of mitosis in onion Studies on the course off meiosis in cereals, millets, pulses and in oilseeds Using micrometers and studying the pollen grain size in various crops - Various methods of staining and preparation and temporary and permanent Slides-Pollens germination in-vitro, Microtomy and steps in microtomy: Agents employed for the induction of various ploidy levels Solution preparation and application at seed. seedling Level-Identification of polyploids in different Crops-Induction and identification of haploids: Morphological observations autopolyploids, Morphological observation on allopolyploids: Morphological on synthesizes observation on aneuploids Cytogenetics analysis of interspecific and intergeneric crosses: Maintenance of Cytogenetic stocks and their importance in crop breeding.

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GP-503- PRINCIPLES OF PLANT BREEDING 3(2+1)

Theory:

UNIT I: History of plant breeding objectives of plant breeding, characteristics improved by plant breeding, patterns of evolution in crop plants Centers of origin biodiversity and its significance.

UNIT II: Genetics basis of breeding: self and cross-pollinated cross including mating system and response to selection nature of variability components of variation Heritability and genetic advance, genotype environment interaction. Types of gene action and implication and plant breeding plant introduction and role of plant genetic resources in plant breeding.

UNIT III: Self-incompatibility aimed male sterility in crop plants and their commercial exploitation Concept plant ideotype and its role in crop improvement, Transgressive breeding.

UNIT IV: Pure line theory, pure line selection and mass selection methods. Line breeding pedigree bulk back cross single seed descent and multiline method Population breeding in self-pollinated crops (diallel selective mating approach).

UNIT V: Breeding methods in asexually clonally propagated crops, clonal selection. Apomixes.

UNIT VI: Breeding for Biotic and Abiotic stresses.

UNIT VII: Cultivar Development-Testing release and notification, maintenance breeding. Participatory Plant Breeding. Plant breeder's right and regulations for plant variety protection and farmer rights.

Practical:

Floral biology in self- and cross-pollinated species, selling and crossing techniques Selection methods in segregating populations and evaluation of breeding materials Analysis of variance (ANOVA), Estimation of heritability and genetic advance. Maintenance of experimental records Learning techniques in hybrid seed production using male sterility in field crops.

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AS 501- AGRICULTURAL STATISTICS 3(2+1)

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 distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distribution. 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 value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient, test of significance of correlation coefficient and regression coefficient, coefficient of determination**.**

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

UNIT V: Uniformity trials, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

UNIT VI: Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling. Estimation of proportion, confidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, non-sampling error-source and classification.

Practical:

To the study about CRD, RBD and LSD designs. Data analysis on correlation and regression on experimental data. Data presentation in bar and pie diagram.

MAA Pateswari University, Balarampur,

SEMESTER II

GPB 504- [PRINCIPLES OF QUANTITATIVE GENETICS] 3(2+1)

Theory:

UNIT I: Mendelian traits vs polygenic traits nature of quantitative traits and its Inheritance-Multiple factor hypothesis-analysis of continuous variation. Variation associated with polygenic traits -phenotypic, genotypic and environmental -non allelic interaction: Nature of gene action -additive, dominance, epistasis and linkage effect.

UNIT II: Principles of analysis of variance (ANOVA) -Expected variance components, random and fixed models. M ANOVA. biplot analysis: Comparison of means and variances for significance

UNIT III: Design for plant breeding experiments -principle and application & Genetic diversity analysis-metroglyph, cluster and D Analysis-Association analysis - phenotypic and genotypic correlations Path analysis and Parent progeny 1 regression analysis: discriminant function and principal component analysis: selection indices- selection of parents' Simultaneous selection models concept of selection-heritability and genetic advance.

UNIT IV: Generation mean analysis Mating design-Diallel, partial diallel, line X tester. NCDs and TTC: Concept of combining ability and gene action Analysis of genotype x environment interaction adaptability and stability Models for GXE analysis and stability parameters.

Practical:

Problems on multiple factor inheritance -Participating of variance -Estimation of heritability and genetic advance Covariance analysis -Metroglyph analysis -D: analysis -Grouping of clusters and interpretation -Cluster analysis Construction of cluster diagram and dendrograms interpretation Correlation analysis Path analysis Parent progeny regression analysis Diallel analysis :Griffiting methods I and II: Diallel analysis Hayma's graphical approach Diallel analysis interpretation of results NCD and their interpretation 1ine x tester analysis and interpretation of results. Estimation of heterosis, standard, mud parental and better-parental heterosis Estimation of inbreeding, depression Generation mean analysis: Analytical part and interpretation, Estimation of different types of gene actions, participating of phenotypic variance into components due to genotypes, environment and genotype x environment Biparental mating. Triallel analysis, Quadrille analysis and Triple Test Cross (TTC)- use of software in analysis and result interpretation Advanced biometrical models for combining ability analysis Models in stability analysis. Additive Mean Effect and Multiplicative Interaction (AMMI) Model.

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GPB-508- [CELL BIOLOGY AND MOLECULAR BIOLOGY] 3(2+1)

Theory:

UNIT I: Ultra structure of the cell differences between eukaryotic and prokaryotic cells, macromolecules, structure and function of cell wall nuclear membrane and plasma membrane Cellular Organelle - nucleus, plastid chloro /chromoplast, mitochondria, endoplasmic reticulum, Golgi complex.

UNIT II: Bioenergetics: Ultrastructure and function of mitochondria, chloroplast and other photo synthetic organelle Interpretation Nucleus-Structure and chemical composition Cell division and physiology of cell division.

UNIT III: Historical background of molecular genetics. Genetic material in organism Structure and properties of nucleic acid.

UNIT IV: DNA content variation, types of DNA Sequences-Unique and repetitive sequences: Organelle genomes Gene amplification and its significance.

Practical:

Morphological and Gram staining of natural n bacteria: Cultivation of bacteria in synthetic medium: Determination of growth rat and doubling rate and doubling time of bacterial cells in culture Demonstration of bacteriophage by plaque assay method: Determination of soluble protein content in a bacterial culture Isolation. purification and raising clonal population of a bacterium: Study of lytic cycle of bacteriophage by one step growth experiment determination of latent period and burst size of phages per cell.

MAA Pateswari University, Balarampur,

PGS 501: [LIBRARY AND INFORMATION SERVICES] 1(0+1)

Objective:

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

Practical:

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 Internal including search engines and its resources; e-resources access methods.

MAA Pateswari University, Balarampur,

PGS 502: [TECHENICAL WRITING AND COMMUNICATION SKILLS] 1(0+1)

Objective:

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

Practical:

Technical writing: Various forms of scientific writings these technical papers, reviews manuals etc. various parts of thesis and research communications (tittle page authorship content page .preface ,introduction review of literature material and method experimental results and discussion): Writing of abstracts summaries precise citations etc :commonly used abbreviations in the theses and research communications :illustration photographs and drawing with suitable captions pagination, numbering of tables and illustration Writing of numbers and dates in scientific writeups Editing and proofreading :Writing of a review of article. Communication skills: Grammar (Tense parts of speech, clauses population marks) Error analysis (Common errors). Concord Collection: Phonetic symbols and transcription: Accentual Pattern: weak forms in connected speech: Participation in group discussion: Facing an interview: presentation of scientific papers.

MAA Pateswari University, Balarampur,

PGS 503: [INTELLECTUAL PROPERTY RIGHTS AND ITS MANAGEMENT IN AGRICULTURE] 1(1+0)

Objective:

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory:

Historical perspectives and need for the introduction of intellectual property right regime: TRIPS and various provision in 'TRIPS Agreement Intellectual property right benefits of securing IPRS :Indian legislations for the protection of various types of intellectual secret and traditional 'knowledge trademarks protection of plant varieties and farmers right and protection Protectable subject matters, protection in biotechnology, protection of other biological materials ownership and period of protection 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.

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Semester III

GPB 506: [BIOTECHNOLOGY FOR CROP IMPROVEMENT] 3(2+1)

Objective: To impart knowledge and practical skills to use biotechnological tools in crop improvement.

Theory:

UNIT I: Biotechnology and its relevance in agriculture: Definitions, terminologies and scope in plant breeding.

UNIT II: Tissue culture History, callus, suspension cultures, cloning. Regeneration: Somatic. Embryogenesis; Anther culture, somatic hybridization techniques, Meristem, ovary and embryo culture: cryopreservation.

UNIT III: Techniques of DNA isolation, quantification and analysis, Genotyping: Sequencing techniques: Vectors vector preparation and cloning. Biochemical and Molecular markers. morphological, biochemical and DNA-based markers (RFI P. RAPD. AFLP SSR.SNPS, FSTs etc.), mapping populations (F2s, back crosses, RILS, NILS and DH).

UNIT IV: Molecular mapping and tagging of agronomically important traits. Statistical tools in marker analysis, Robotics; Marker-assisted selection for qualitative and quantitative traits QTLs analysis in crop plants, Gene pyramiding.

UNIT V: Marker assisted selection and molecular breeding: Genomics and geoinformatics for crop improvement, integrating functional genomics information on agronomically/ economically important traits in plant breeding; Marker-assisted backcross breeding for rapid introgression. Generation of EDVS.

UNIT VI: Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer Production of transgenic plants in various field crops: cotton, wheat, maize, rice, soybean, oilseeds, sugarcane etc. Commercial releases.

UNIT VII: Biotechnology applications in male sterility by hybrid breeding, molecular farming.

UNIT VIII: MOs and related issues (risk and regulations); GMO: International regulations, biosafety issues of GMOs; Regulatory procedures in major countries including India, ethical, legal and social issues; Intellectual property rights.

UNIT IX: Bioinformatics & Bioinformatics tools.

UNIT X: Nanotechnology and its applications in crop improvement programs.

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Practical:

Requirements for plant tissue culture Laboratory-Techniques in plant tissue culture- Media components and media preparation -Aseptic manipulation of various explants. observations on the contaminants occurring in media - interpretations - Inoculation of explants: Callus induction and plant Regeneration-Plant regeneration, Standardizing the protocols for regeneration, hardening of regenerated plants; Establishing a green- house and hardening procedures Visit to commercial micropropagation unit. Trans-formation using Agrobacterium strains, GUS assay in transformed cells/tissues. DNA isolation, DNA purity and quantification tests, gel electrophoresis of proteins and isozymes, PCR based DNA markers, gel scoring and data analysis for tagging and phylogenetic relationship, construction of genetic linkage maps using computer soft- ware.

MAA Pateswari University, Balarampur,

GPB 507: [BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANCE] 3(2+1)

Objective: To apprise about various abiotic and biotic stresses influencing crop yield, mechanisms and genetics of resistance and methods to breed stress resistant varieties.

Theory:

UNIT I: Importance of plant breeding with special reference to biotic and abiotic stress resistance. Classification of biotic stresses- major pests and diseases of economically important crops Concepts in insect and pathogen resistance; Host defense responses to pathogen invasions- Biochemical and molecular mechanisms: Acquired and induced immunity and systemic acquired resistance (SAR), Host pathogen interaction, gene for gene hypoth esis, molecular evidence for its operation and exceptions: Concept of signal transduction and other host-defense mechanisms against viruses and bacteria.

UNIT II: Types and genetic mechanisms of resistance to biotic stresses -Horizontal and vertical resistance in crop plants. Quantitative resistance/Adult plant resistance and Slow Rusting Resistance-Classical and molecular breeding methods Measuring plant resistance using plant fitness: Behavioral, physiological and insect gain studies.

UNIT III: Phenotypic screening methods for major pests and diseases; Recording of observations; Correlating the observations using market data - Gene pyramiding methods and their implications.

UNIT IV: Classification of abiotic stresses - Stress inducing factors moisture stress/drought and water logging & submergence: Acidity, salinity alkalinity/sodicity, High/low temperature, wind, etc. Stress due to soil factors and mineral toxicity, Physiological and Phenological responses; Emphasis of abiotic stresses in developing breeding methodologies.

UNIT V: Genetics of abiotic stress resistance, Genes and genomics in breeding cultivars suitable to low water regimes and water logging & submergence, high and low/freezing temperatures: Utilizing MAS procedures for identifying resistant types in important crops like rice, sorghum, wheat, cotton etc. Breeding for resistance to stresses caused by toxicity. deficiency and pollutants/contaminants in soil, water and environment.

UNIT VI: Exploitation of wild relatives as a source of resistance to biotic and abiotic factors in major field crops - Transgenic in management of biotic and abiotic stresses, use of toy- ins, protease inhibitors, lectus, chinases and Br for diseases and insect pest Management-Achievements.

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Practical:

Phenotypic screening techniques for sucking pests and chewing pests -Traits to be observed at plant and insect level - Phenotypic screening techniques for nematodes and borers: Ways of combating them, Breeding strategies - Weeds - ecological, environ- mental impacts on the crops, Breeding for herbicide resistance - Evaluating the available populations like RIL, NIL etc. for pest resistance; Use of standard MAS procedures-Phenotypic screening methods for diseases caused by fungi and bacteria, Symptoms and data recording; use of MAS procedures Screening forage crops for resistance to sewage water and tannery effluents: Quality parameters evaluation - Screening crops for drought and flood resistance; factors to be considered and breeding strategies - Screening varieties of major crops for acidity and alkalinity their effects and breeding strategies: Understanding the climatological parameters and predisposal of biotic and abiotic stress factors- ways of combating them.

MAA Pateswari University, Balarampur,

GPB 505: [MAINTENANCE BREEDING AND CONCEPTS OF VARIETY RELEASE AND SEED PRODUCTION] 3(2+1)

Objective: To apprise the students about the variety deterioration and steps to maintain the purity of varieties & hybrids and principles of seed production in self- & cross-pollinated crops.

Theory:

UNIT I: Variety Development and Maintenance: Definition variety, cultivar, extant variety. essentially derived variety, independently derived variety. reference variety, farmers' variety, hybrid and population; Variety testing, release and notification systems in India and abroad.

UNIT II: DUS testing- DUS Descriptors for major crops, Genetic purity concept and maintenance breeding. UNIT III: Factors responsible for genetic deterioration of varieties safeguards during seed production; Maintenance of varieties in self and cross-pollination crops- isolation distance: Principles of seed production; Methods of nucleus and breeder seed production.

UNIT IV: Generation system of seed multiplication-nucleus, breeders, foundation, certified. -Quality seed production technology of self and cross-pollinated crop varieties viz. cereals & millets (wheat, barley, paddy, pearl millet, sorghum, maize and ragi etc.): Pulses (green gram, black gram, cowpea, pigeon pea, chickpea, field pea, lentil). Oilseeds (groundnut, soybean, sesame, castor, sunflower, safflower, linseed, rapeseed and mustard); fibers (cotton, jute)) and forages (guar, forage sorghum, oats, berseem, lucerne). Seed certification procedures: Seed laws and plant variety protection regulations in India and international systems.

Practical:

Identification of suitable areas/locations for seed production; Ear-to-row method and nucleus seed production - Main characteristics of released and notified varieties, hybrids and parental lines; Identification of important weeds objectionable weeds: Determination of isolation distance and planting ratios in different crops, Seed production techniques of varieties in different crops. Hybrid seed production technology of important crops.

MAA Pateswari University, Balarampur,

CA 502: [Computer Application in Agriculture] 2(1+1)

Theory:

Introduction to computer, operating system, definition and types, application of Ms-Office for document creation & editing, data presentation, interpretation and graph creation, statistical analysis, mathematical expression, database concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW); Memory, Basic Anatomy of Computer System. e-Agriculture concepts and applications. Use of ICT in Agriculture. IT application for computation water and nutrient requirement of crops, computer-controlled devices (automated systems) for agri-input management, Smart phone Apps in Agriculture. Decision support systems, concepts, components and applications in agriculture.

Practical:

Study of computer components, accessories, practice of important DOS Commands, introduction of different operating system such as window, files & folders, File Management. Use of MS- Word and MS Power point for creating, editing and presenting a scientific document. MS-Excel - Creating a spread sheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access Creating database.

MAA Pateswari University, Balarampur,

PGS 504: [BASIC CONCEPTS IN LABORATORY TECHNIQUES] 1(0+1)

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 pol 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: 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.

MAA Pateswari University, Balarampur,

PGS 505: [AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES] 2(2+0)

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 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.

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 programs Community Development Programme, Intensive Agricultural District Programme, Special group - Area Specific Programme, Integrated Rural Development programme (IRDP) Panchayati Raj Institutions. Cooperatives. Voluntary Agencies Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

MAA Pateswari University, Balarampur,

PGS 506: [DISASTER MANAGEMENT] 1(1+0)

Objective: To introduce learners to the key concepts and practices of natural disaster management. to equip them to conduct thorough assessment of hazards, and risks vulnerability, and capacity building.

Theory:

UNIT I: Natural Disasters - Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change. Global warming, Sea level rise. Ozone depletion.

UNIT II: Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire oil fire, air pollution, water pollution, deforestation, Indus- trial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III: Disaster Management- Efforts to mitigate natural disasters at national and global levels international strategy for disaster reduction. Concept of disaster management, national disaster management framework financial arrangements, role of NGOs, Community- based organizations, and media Central, state, district and local administration, Armed forces in disaster response: Disaster response. Police and other organizations.

MAA Pateswari University, Balarampur,

Semester IV

GPB 591: Master Seminar 1 (0+1) Presentation on relevant topic of concerned discipline

GPB 599: Master Research (Thesis) 20 (0+20) Perform research work and thesis writing on topic or title related to discipline of Genetics & Plant Breeding.

GPB 509: [BREEDING FOR QUALITY TRAITS (Special Paper)] 4(3+1)

Objective: To provide insight into recent advances in improvement of quality traits in rice, millets. Legumes, oilseeds and forage crops and for physiological efficiency using conventional and modern biotechnological approaches.

Theory: UNIT I: Developmental biochemistry and genetics of carbohydrates, proteins, fats, vitamins. Amino acids and antinutritional factors Nutritional Improvement A human perspective Breeding for grain quality parameters in rice and its analysis Golden rice and aromatic rice Breeding strategies, achievements and application in Indian Context Molecular basis of quality traits and their manipulation in nce Post harvest manipulation for quality improvement.

UNIT II: Breeding for baking qualities in wheat: Characters to be considered and breeding Strategies-Molecular and cytogenetic manipulation for quality improvement in Wheat-Breeding for quality improvement in barley and oats.

UNIT III: Breeding for quality improvement in Sorghum and pearl millet. Quality protein maize Concept and breeding strategies - Breeding for quality improvement in forage crops - Genetic resource management for sustaining nutritive quality in crops.

UNIT IV: Breeding for quality in pulses Breeding for quality in groundnut, sesame, sunflower and minor oilseeds Molecular basis of fat formation and manipulation to achieve more PUFA in oil crops; Genetic manipulation for quality improvement in cotton.

UNIT V: Genetic engineering protocols for quality improvement Achievements made - Value addition in crops; Classification and Importance-Nutritional genomics and Second generation transgenics.

Practical:

Grain quality evaluation in rice: Correlating ageing and quality improvement in rice- Quality analysis in millets: Estimation of anti -nutritional factors like tannin, in different varieties/hybrids. A comparison - Quality parameters evaluation in wheat: Quality parameters evaluation in pulses Quality parameters evaluation in oilseeds. Value addition in crop plants: Post harvest processing of major field crops. Quality improvement in crops through tissue culture techniques. Evaluating the available populations like RIE, NIL etc. for quality improvement using MAS procedures.

MAA Pateswari University, Balarampur,

GPB 510- [GENE REGULATION AND EXPRESSION (Special Paper)] 4(4+0)

Objective: To provide insight into recent advances in the phenomenon of gene regulation and mechanisms by which plants and microbes express different traits and how these are modified during different stages.

Theory:

UNIT I: Introduction: Gene regulation purpose. Process and mechanisms in prokaryotes and eukaryotes; Levels of gene controls.

UNIT II: Coordinated genetic regulation-examples Anthocyanin and gene families and maize, Genetic and molecular basis depending on tissue specificity.

UNIT III: Gene Expression-Transposons in plant gene expression, cloning-transposon tagging; Light regulated gene expression model systems in Arabidopsis and maize, Para mutations and imprinting of genes and genomes.

UNIT IV: Transgene expression and gene silencing mechanisms, Regulatory genes horizontal and vertical homology: Transformation regulatory genes as visible markers. Reporter systems to study gene expression; combinatorial gene control.

UNIT V: Eukaryotic transcriptional control: Translational and post-translational regulation: Signal transduction: Stress-induced gene expression; Gene traps and enhancer traps.

GPB 511: [DATABASE MANAGEMENT, EVALUATION AND UTILIZATION OF PGR (Special Paper)] 4(3+1)

Objective: To train the students in germplasm data base management using modern tools and software's.

Theory:

UNIT I: Statistical techniques in management of germplasm: Core identification, estimation of sample size during plant explorations, impact of sampling on population structure, sequential sampling for viability estimation: Introduction of binomial, normal and negative cumulative normal, use of Probit scales, viability equations and nomograms: Estimation of sample size for storage and viability testing.

UNIT II: Germplasm documentation; Basics of computer and operating systems. Database management system, use of statistical software, pictorial and graphical representation of data, introduction to communication network.

UNIT III: Germplasm management system- global scenario; Genetic variation in crop plants and management of germplasm collection, limitations in use of germplasm collections, necessity of germplasm evaluation: Predictive methods for identification of useful germplasm. Characterization of germplasm and evaluation procedures including specific traits: Gene markers and their use in PGR management.

UNIT IV: Management and utilization of germplasm collections; Concept of core collection, molecular markers and their use in characterization: Evaluation and utilization of genetic resources. Pre-breeding genetic enhancement, utilizing wild species for crop improvement: Harmonizing agro biodiversity and agricultural development crop diversification participatory plant breeding.

Practical:

Basics of computer and operating systems: Identification of useful germplasm, evaluation of crop germplasm: Statistical techniques in management of germplasm estimation of sample size for storage und viability testing: Evaluation procedure and experimental protocols (designs and their analysis), Assessment of genetic diversity, Techniques of Characterization of germplasm: Molecular markers and their use in characterization.

GPB 512- [GERMPLASM COLLECTION, EXCHANGE AND QUARANTINE] 4(3+1)

Objective: To provide information about collection, germplasm exchange, quarantine maintenance and use of plant genetic resources including genetically modified plants.

Theory:

UNIT I: History and importance of germplasm exploration: Distribution and extent of prevalent genetic diversity, Phyto geographical regions/ecological zones and associated diversity. Mapping eco-geographic distribution of diversity, threatened habitats, use of flora.

UNIT II: Concept of population and gene pool Variations in population and their classification, Gene frequencies in populations, rare and common alleles, Gene pool sampling in self and cross pollinated and vegetative propagated species. Non selective random and selective sampling strategies, Strategies and logistics of plant exploration and collection Coarse and fine grid surveys; Practical problems in plant exploration, Use of in vitro methods in germplasm collection.

MAA Pateswari University, Balarampur,

UNIT III: Ethno botanical aspects of PGR: Crop botany, farming systems, collecting wild relatives of crop plants; Collection and preservation of specimens. Importance and use of herbaria and preparation of herbarium specimens.

UNITIV: Post-exploration handling of germplasm collections Present status and future strategies in collection of major crops of Indian origin such as rice, maize, sorghum, sesame, Brassica, okra, eggplant, cotton, mango ete; approaches for collection including indigenous knowledge.

UNIT V: History, principles, objectives and importance of plant introduction, Prerequisites, conventions, national and international legislations and policies in germplasm collection and exchange; Documentation and information management: Plant quarantine introduction, history, principles, objectives and relevance, Regulations and plant quarantine set up in India; Pest risk analysis, pest and pathogen information database: Quarantine in relation to integrated pest management. Economic significance of seed-borne pests (in- sects, mites, non-insect pests, nematodes, bacteria, viruses, phytoplasma etc.

UNIT VI: Detection and identification of pests including use of recent techniques like ELISA, PCR etc., Symptoms of pest damage, salvaging techniques for infested infected germplasm. post-entry quarantine operation, seed treatment and other prophylactic treatments and facilities; Domestic quarantine; seed certification; International linkages in plant quarantine: weaknesses and future thrust.

UNIT VII: Genetically modified organisms (GMOs) or genetically engineered plants (GEPS), Concepts of biosafety, risk analysis and consequences of spread of GE crops on the environment: Treaties and multilateral agreements governing trans boundary movement of GEP or GMOs. Indian regulatory system for biosafety.

Practical:

Plant exploration and collection; Techniques of coarse and fine grid surveys. Identification of wild relatives of crop plants- Example of collection, cataloguing and preservation of specimens: Sampling techniques of plant materials; Visiting ports, airports to study the quarantine regulations, Techniques for the detection of insects, mites, nematodes, bacteria, weeds, pathogens and viruses on seed and planting materials and salvaging; Use of visual, qualitative, quantitative, microscopic, molecular and plant growth related techniques(controlled greenhouses/growth chambers, etc); Detection of GMOs and GEPS, Study of post-entry quarantine operation, seed treatment and other prophylactic treatments.

MAA Pateswari University, Balarampur,

PB 513- [BREEDING LEGUMES, OILSEEDS AND FIBRE CROPS (Special Paper)] 4(3+1)

Objective: To provide insight into recent advances in improvement of legumes, oilseeds and fiber crops using conventional and modern biotechnological approaches.

Theory: UNIT I: Pigeon pea: Evolution and distribution of species and forms. Will relatives and germplasm Genetics, cytogenetics and genome relationship. Morphological and molecular descriptors used for differentiating the accessions: Breeding objectives yield, quality characters, biotic and abiotic stress etc Hybrid technology, maintenance of male sterile fertile and restorer lines, progress made at ICRISAT and other Institutes.

UNIT II: Chickpea. Evolution and distribution of species and forms- Wild relatives and germplasm-cytogenetic and genome relationship: Breeding objectives- yield, quality characters. biotic and abiotic stress etc: Protein quality improvement: Conventional and modern plant breeding approaches, progress made Breeding for anti -nutritional factors.

UNIT III: Other pulses: green gram, black gram, field pea, lentil, lathyrus, cowpea, lablab, moth bean, Evolution, cytogenetics and genome relationship: I caring the descriptors. Breeding objectives- yield, quality characters biotic and abiotic stress etc. Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them.

UNITIV: Groundnut: Evolution and distribution of species and forms; Wild relatives and germplasm; Cytogenetics and genome relationship, Pod and kernel characters: Breeding objectives- yield, quality characters, biotic and abiotic stress etc.

UNIT V: Rapeseed and Mustard: Breeding objectives, utilization of wild relatives for yield and quality improvement, biotic and abiotic stress etc. Oil quality characteristics in different oils: Evolution and distribution of species and forms: Wild relatives and germplasm: Genetics, cytogenetic and genome relationship.

UNIT VI: Soybean: Breeding objectives, utilization of wild relatives for yield and quality improvement, biotic and abiotic stress etc. Oil quality-characteristics: Evolution and distribution of species and forms, Wild relatives and germplasm. Genetics, cytogenetics and genome relationship.

UNIT VII: Other oilseed crops: Sunflower, sesame safflower, niger. Evolution and distribution of species and forms, Wild relatives and germplasm: Cytogenetics and genome relationship; breeding objects use yield, quality characters, biotic and abiotic stress: Sunflower Evolution and distribution of species and forms: Wild relatives and germplasm. Cytogenetics and genome relationship, hybrid sunflower, constraints and achievements.

UNIT VIII: Castor. Evolution and distribution of species and forms, Wild relatives and germplasm Cytogenetics and genome relationship, breeding objectives yield, quality characters biotic and abiotic stress etc - Hybrid breeding m castor opportunities constraints and achievements.

UNITIX: Cotton: Evolution of cotton, Breeding objectives- yield, quality characters, biotic and abiotic stress etc; Development and maintenance of male sterile lines - Hybrid development and seed production - Scenario of Bt cottons, evaluation procedures for Bt cotton. Jute: Evolution and distribution of species and forms; Wild relatives and germplasm Cytogenetics and genome relationship, breeding objectives- yield, quality characters. Biotic and abiotic stress etc. Mesta and minor fiber crops Evolution and distribution of species and forms, Wild relatives and germplasm. Cytogenetics and genome relationship. Breeding objectives- yield, quality characters, biotic and abiotic stress etc.

UNIT X: Distinguishing features of the released varieties in pulses, oilseeds and cotton: Maintenance of seed purity and seed production.

Practical:

Use of descriptors for cataloguing Floral biology emasculation pollination techniques, Study of range of variation for yield and yield components Study of segregating populations in red gram, green gram, Black gram and other pulse crops. Attempting crosses between black gram and green gram. Use of descriptors for cataloguing - Floral biology, emasculation, pollination techniques of oilseed crops like Sesame, Groundnut. Sunflower and Castor, Cotton: Use of descriptors for cataloguing Floral biology- learning on the crosses between different species- Cotton, Study of range of variation for yield and yield components Study of segregating populations - evaluation- Trait based screening for stress resistance-Cotton, fiber quality evaluation- conventional and modern approaches: analyzing the lint samples of different species interspecific and interracial derivatives for fiber quality and interpretation - Development and maintenance of male sterile lines Evaluation of cotton cultures of different species for insect and disease resistance Leaming the mechanisms of resistance quantifying the resistance using various parameters, Evaluating the germplasm of cotton for yield, quality and resistance parameters - learning the procedures on development of Bt cotton - Visit to Cotton Technology Laboratory and Spinning Mills-Learning on cotton yarn production, its quality evaluation and uses

MAA Pateswari University, Balarampur,

M.Sc. (AG) Entomology

I Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
AE 501	Insect Morphology	4(3+1)	20	50	30	100
AE 502	Insect Systematics	3(2+1)	20	50	30	100
AE 503	Insect Anatomy, Physiology and Nutrition	3(2+1)	20	50	30	100
AS 501	Agricultural Statistics	3(3+1)	20	50	30	100
PGS 501	Library and Information Services (Non Gradial 50% Marks Required For Satisfactory)	1(0+1)	Satisfactory/non satisfactory 50% marks required of satisfactory grade			
		14				

II Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
AE 504	Insect Ecology	3(2+1)	20	50	30	100
AE 505	Toxicology of Insecticides	3(2+1)	20	50	30	100
AE 506	Plant Resistance to Insects	3(2+1)	20	50	30	100
PGS-505	Agricultural research, research ethics and Rural development Programmes (Non gradial)	2(2+0)	40	60	00	100
PGS-502	Technical Writing and Communications Skills (Non gradial)	1(0+1)	00	00	100	100
PGS-503	Intellectual Property and Its Management in agriculture (Non gradial)	1(1+0)	40	60	00	100
AE 506	Integrated Insect Pest Management	3(2+1)	20	50	30	100
		16				

MAA Pateswari University, Balarampur,

III Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
CA-502	Computer application in Agriculture	2(1+1)	20	50	30	100
AE 508	Advance Techniques in Plant Protection	3(2+1)	20	50	30	100
AE 509	Biological Control	3(2+1)	20	50	30	100
AE 510	Insect Vectors of Plant Viruses and other Pathogens	3(3+1)	20	50	30	100
PGS 504	Basic Concepts in Laboratory Techniques (Non gradial)	1(0+1)	00	00	100	100
		12				

IV-Semester

Code No.	Course Title	Credit Hours	
AE-591	Master Seminar	1(0+1)	**Presentation**
AE-599	Master Research (Thesis)	20	**Research**

OR
Special Paper (20 Credits) Satisfactory/ Unsatisfactory

			Evaluation marks			
Code No.	Course Title	Credit Hours	Mid Term	Theory	Practical	Total
AE-511	Principles of Insect Pest Management	4(3+1)	20	50	30	100
AE-512	Biological Control of Crop Pests and Weeds	4(3+1)	20	50	30	100
AE-513	Pests of Field Crops	4(3+1)	20	50	30	100
AE-514	Pests of Horticultural and Plantation Crops	4(3+1)	20	50	30	100
AE-515	Storage Pest and Their Management	4(3+1)	20	50	30	100
		20				

Note- Passing marks in particular paper is 55%
Grade = Marks obtained in particular course divided by 10
The minimum grade point average (GPA) must be 5.5 in every semester
Pass : **5.5-5.99**
Second Division : **6.0-6.99**
First Division :**7.0-7.99**
First division with distinction : **8.0 and above**

MAA Pateswari University, Balarampur,

I Semester

AE-501 INSECT MORPHOLOGY 4(3+1)

Theory:

UNIT I: Principles, utility and relevance: insect body wall structure, circular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.

UNIT II: Head- Origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites.

UNIT III: Thorax- Areas. and sutures of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; Legs: structure and modifications.

UNIT IV: Abdomen- Segmentation and appendages; Genitalia and their modifications; Embryonic and post-embryonic development; Types of metamorphosis. Insect sense organs (mechano-, photo and chemoreceptors).

Practical:

Study of insect segmentation, various tagmata and their appendages. Preparation of permanent mounts of different body parts and their appendages of taxonomic importance. Preparation of permanent mounts or male and female genitalia. Study about Sense organs in Insects. Identification or different types of Insect Antennae. Modification of different type of legs and wings.

MAA Pateswari University, Balarampur,

AE-502 INSECT SYSTEMATICS 3(2+1)

Theory:

UNIT I: Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda - Classes - Ellipura (Collembola, Protura), Diplura and Insecta- Orders contained.

UNIT II: Distinguishing characters, general biology, habits and habitats of Insects orders and economically important families contained in them. Collembola, Protura, Diplura. Class Insecta: Subclass Apterygota - Archaeognatha, Thysanura Subclass: Pterygota, Division Palaeoptera Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders- (Oligoneoptera: Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders –(Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera

UNIT III: Distinguishing characters, general biology, habits and habitats of Insects orders and economically important families contained in them. Isoptera, Mantodea, Grylloblattodea, Dermaptera Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera, Subdivision: Hemipteroid Orders -(Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.

UNIT IV: Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them (Continued). Division Neoptera - Subdivision Endopterygota, Section Neuropteroid- Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpoid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

Practical:

Study of Orders of insects and their identification using taxonomic keys. Keying out families of insects of different major Orders: Odonata, Orthoptera, Blartodea, Mantodea, Isoptera, Hemiptera, Thysanoptera, Phthiraptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera. Field visits to collect insects of different orders.

MAA Pateswari University, Balarampur,

AE-503 INSECT ANATOMY, PHYSIOLOGYAND NUTRITION 3(2+1)

Theory:

UNIT I: Scope and importance of insect anatomy and physiology.

UNIT II: Structure, modification and physiology of different systems- digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands.

UNIT III: Thermodynamics; physiology of integument, mounting; growth, metamorphosis and diapause.

UNIT IV: Insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular microorganisms and their role in physiology; artificial diets.

Practical:

Dissection of different insects to study comparative anatomical details of different systems. Preparation of permanent mounts of internal systems. Chromatographic analysis of free amino acids of hemolymph. Determination of chitin in insect cuticle; examination of insect's hemocytes; determination of respiratory quotient. Preparation and evaluation of various diets; consumption, utilization and digestion of natural and artificial diets.

MAA Pateswari University, Balarampur,

AS 501- AGRICULTURAL STATISTICS 3(2+1)

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 distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distribution. 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 value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient, test of significance of correlation coefficient and regression coefficient, coefficient of determination**.**

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

UNIT V: Uniformity trials, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

UNIT VI: Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling. Estimation of proportion, confidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, non-sampling error-source and classification.

Practical:

To the study about CRD, RBD and LSD designs. Data analysis on correlation and regression on experimental data. Data presentation in bar and pie diagram.

MAA Pateswari University, Balarampur,

PGS-501 LIBRARY AND INFORMATION SERVlCES 1(0+l)

Theory

UNIT I: To equip the library users with skills to trace information from libraries efficiently.

UNIT II: To apprise them of information and knowledge resources, to carry out literature survey.

UNIT III: To formulate information search strategies.

UNIT IV: To use modem tools (Internet, OP AC, search engines etc.) of information search.

Practical

l. Introduction to library and its services

2. Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources.

3. 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; Use of CD-ROM Databases.

5. Online Public Access Catalogue and other computerized library services.

6. Use of Internet including search engines and its resources; access methods.

MAA Pateswari University, Balarampur,

II Semester

INSECT ECOLOGY (AE-504) Credit: 3(2+1)

Theory:

Basic concepts - population and environment, Population regulation - natural control and current theories, Characteristics of population, Biotic potential and environmental resistance, Stable age distribution, population dynamics, Diapause, hibernation and aestivation, Effect of environmental factors on distribution and abundance of insects, Food chain and ecological succession, Ecological indicators.

Practical:

Measurement of micro-environments, Concepts of life table and construction of life tables, Computer simulation, modeling, Estimates of population density, Sampling methods and plans, Estimation of dispersion and migration.

TOXICOLOGY OF INSECTICIDES (AE-505) Credit: 3(2+1)

Theory:

Principal of toxicology, Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature. Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrazoles, insect growth regulators, microbials, botanicals, new promising compounds viz. evermectin. Insecticide metabolism and toxicity, synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity. Insecticide residue - their significance, analysis and environmental applications. Diagnosis and treatment of insecticide poisoning, Plant products, Formulations. Rules of insecticide registration and quality control(s). Application techniques and hazards.

MAA Pateswari University, Balarampur,

Practical:

Preparation of laboratory formulations and standard concentration of insecticides, Bioassay technique, Testing of relative toxicity and synergism, Sampling for insecticide residue, their extraction, cleanup and estimation, compatibility of pesticides, phytotoxicity, toxicity to beneficial insects, Scrutiny of pesticides containers with reference to Insecticide Act, 1968, Evaluation of spray particles. Assessment of efficacy of Insecticides under laboratory and field conditions correction for natural mortality, Fixing LD50, LC50 and LT50 for insecticide. Dragssdedt Behrens-Graphical and Finney's methods - probit analysis.

HOST PLANT RESISTANCE TO INSECTS (AE-506) Credit: 3(2+1)

Theory:

History and importance, resistance, principles, classification, components, types and mechanisms of resistance, factors that affect the expression or permanence of resistance, Role of volatiles and secondary plant substances in host selection, Chemoreception, phagostimulants, Peculiarities of plant reaction to pest injury, Methods of investigating pest resistance, genetically modified plants for pest resistance, Resistance to insects in major crops.

Practical:

Use of planimeter, Graphic technique and choice tests for measuring resistance, Measurement of plant characters and working out their correlation with plant resistance, Testing of resistance in important crops, Bioassay of plant extracts of susceptible/resistant varieties, Demonstration of antibiosis, preference and non-preference.

MAA Pateswari University, Balarampur,

AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (PGS-505) Credit: 2(2+0)

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 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.

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 Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

MAA Pateswari University, Balarampur,

TECHNICAL WRITING AND COMMUNICATIONS SKILLS (PGS-502) Credit: 1(0+1)

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

Practical: Technical Writing: Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, precis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills: Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech; Participation in group discussion; Facing an interview; presentation of scientific papers.

INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (PGS-503) Credit: 1(1+0)

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

Theory: 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; 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; 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.

MAA Pateswari University, Balarampur,

INTEGRATED INSECT PEST MANAGEMENT (AE-507) Credit: 3(2+1)

Theory:

The concept and history of pest management, Components of pest management, Ecological and socio-economic aspects, cost benefit ratio and risk/benefit ratios, Tools of pest management and their integration-legislative, cultural, physical and mechanical methods; Sampling and measuring the economic levels of damage, economic injury levels and economic threshold level, Analysis and modeling for pest management and case histories, Decision and succession of crop pests as influenced by biotic and abiotic factors and time series analysis in pest management, Pest management in major crops, Integration of IPM options in integrated farming systems and sustainable agriculture.

Practical:

Collection and identification of natural enemies of insect pests of rice, pigeon pea, vegetables and oilseeds, Calculation of diversity index and economic thresholds, Demonstration of IPM technology in field crops, Scouting, Impact analysis, IPM in protected cultivation system.

MAA Pateswari University, Balarampur,

III Semester
CA 502: [Computer Application in Agriculture] 2(1+1)

Theory:

Introduction to computer, operating system, definition and types, application of Ms-Office for document creation & editing, data presentation, interpretation and graph creation, statistical analysis, mathematical expression, database concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW); Memory, Basic Anatomy of Computer System. e-Agriculture concepts and applications. Use of ICT in Agriculture. IT application for computation water and nutrient requirement of crops, computer-controlled devices (automated systems) for agri-input management, Smart phone Apps in Agriculture. Decision support systems, concepts, components and applications in agriculture.

Practical:

Study of computer components, accessories, practice of important DOS Commands, introduction of different operating system such as window, files & folders, File Management. Use of MS- Word and MS Power point for creating, editing and presenting a scientific document. MS-Excel - Creating a spread sheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access Creating database.

AE-508: Advanced Techniques in Plant Protection **Credits: 3 (2+1)**

THEORY:

Pest control equipment, principles, operation, maintenance, selection, application of pesticides and biocontrol agents, seed dressing, soaking, root-dip treatment, dusting, spraying, application through irrigation water. Soil sterilization, solarization, deep ploughing, flooding, techniques to check the spread of pests through seed, bulbs, corms, cuttings and cut flowers. Use of light, transmission and scanning electron microscopy. Microscopy. Use of tissue culture techniques in plant protection. Computer application for predicting/forecasting pest attack and identification.

PRACTICAL:

Identification and learning about various plant protection equipment and their parts, calibration of sprayers, seed dressing, soaking, root dip treatment, dusting, spraying (low and high-volume sprayers), solarization, microscopy.

MAA Pateswari University, Balarampur,

AE-509: Biological Control Credits: 3 (2+1)

THEORY:

UNIT I:

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control – importation, augmentation and conservation.

UNIT II:

Biology, adaptation, host seeking behavior of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects.

UNIT III:

Mass production of quality biocontrol agents – techniques, formulations, economics, field release/application and evaluation.

UNIT IV:

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies – quarantine regulations, biotechnology in biological control. Semi chemicals in biological control.

PRACTICAL:

Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers. Visits (where feasible) to biocontrol laboratories to learn rearing and mass production of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds. Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

MAA Pateswari University, Balarampur,

AE-510 INSECT VECTORS OF PLANT VIRUSES AND OTHER PATHOGENS Credits: 3(2+1)

THEORY

UNIT I: History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission.

UNIT II: Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors.

UNIT III: Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.

UNIT IV: Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers.

UNIT V: Transmission of plant viruses by psyllids, beetles and mites. Epidemiology and management of insect transmitted diseases through vector management.

PRACTICAL

Identification of common vectors of plant pathogens—aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; culturing and handling of vectors; demonstration of virus transmission through vectors—aphids, leafhoppers and whiteflies.

PGS 504: [BASIC CONCEPTS IN LABORATORY TECHNIQUES] 1(0+1)

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 pol 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: 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.

MAA Pateswari University, Balarampur,

IV SEMESTER

AE 591: Master Seminar 1 (0+1) Presentation on relevant topic of concerned discipline

AE 599: Master Research (Thesis) 20 (0+20) Perform research work and thesis writing on topic or title related to discipline of Genetics & Plant Breeding.

AE-511 PRINCIPLES OF INSECT PEST MANAGEMENT Credits: 4(3+1)

OBJECTIVE

To familiarize the students with principles of insect pest management, including concept and philosophy of integrated pest management (IPM). Train students in computation of ETL, implementing IPM programmes.

THEORY

UNIT I: History and concepts; ecological and sociological aspects; determination of single- and multi-pest economic injury level, and natural enemy-based economic levels.

UNIT II: Dimensions of insect plant interactions and advances in varietal resistance including transgenics to crop pests; biological, chemical, legal, cultural, genetic, behavioral and other management tactics and development of IPM modules; impact assessment.

UNIT III: Analysis of spatial distribution, sampling, measuring economic levels of damage and modeling; biotype development and importance of biosystematics in pest diagnostics; bio-intensive IPM; bio-pesticides and toxicology in pest management, sanitary and phytosanitary measures; effect of radiations on insects, sterile male techniques.

UNIT IV: Wide area management of epidemics of crop pests; case studies on pests of national importance and their management.

PRACTICAL

Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment—direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system.

MAA Pateswari University, Balarampur,

AE-512 BIOLOGICAL CONTROL OF CROP PESTS AND WEEDS 4 (3+1)

THEORY

UNIT I

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control – importation, augmentation and conservation.

UNIT II

Biology, adaptation, host seeking behavior of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects.

UNIT III

Mass production of quality biocontrol agents – techniques, formulations, economics, field release/application and evaluation.

UNIT IV

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies – quarantine regulations, biotechnology in biological control. Semi-chemicals in biological control.

PRACTICAL

Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers. Visits (only where logistically feasible) to biocontrol laboratories to learn rearing and mass production of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds. Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

MAA Pateswari University, Balarampur,

AE-513 PESTS OF FIELD CROPS 4 (3+1)

OBJECTIVE

To familiarize the students about nature of damage and seasonal incidence of insect pests that cause loss to major field crops and their effective management by different methods.

THEORY

UNIT I

Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors.

UNIT II

Insect pests of cereals and millets and their management. Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs etc.).

UNIT III

Insect pests of pulses, tobacco, oilseeds and their management.

UNIT IV

Insect pests of fiber crops, forages, sugarcane and their management.

PRACTICAL

Field visits, collection and identification of important pests and their natural enemies; detection and estimation of infestation and losses in different crops; study of life history of important insect pests.

MAA Pateswari University, Balarampur,

AE-514 PESTS OF HORTICULTURAL AND PLANTATION CROPS 4 (3+1)

OBJECTIVE

To impart knowledge on major pests of horticultural and plantation crops regarding the extent and nature of loss, seasonal history, their integrated management.

THEORY

UNIT I

Systematic position, identification, distribution, host range, bionomics and seasonal abundance, nature and extent of damage and management of insect pests of various crops.

UNIT II

Fruit Crops – mango, guava, banana, jack, papaya, pomegranate, litchi, grapes, ber, fig, citrus, aonla, pineapple, apple, peach and other temperate fruits.

UNIT III

Vegetable crops – tomato, potato, radish, carrot, beetroot, cole crops, French beans, chow-chow, brinjal, okra, all gourds, gherkin, drumstick, leafy vegetables etc.

UNIT IV

Plantation crops – coffee, tea, rubber, coconut, arecanut, cashew, cocoa etc.;

Spices and Condiments – pepper, cardamom, clove, nutmeg, chillies, turmeric, ginger, betelvine etc.

UNIT V

Ornamental, medicinal and aromatic plants and pests in polyhouses/protected cultivation.

PRACTICAL

Collection and identification of important pests and their natural enemies on different crops; study of life history of important insect pests and non-insect pests.

MAA Pateswari University, Balarampur,

AE-515 STORAGE PEST AND THEIR MANAGEMENT 4 (3+1)

THEORY

UNIT I Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses in toto vis-à-vis total production of food grains in India. Scientific and socio-economic factors responsible for grain losses.

UNIT II Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes.

UNIT III Ecology of insect pests of stored commodities/grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage – types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities' storage conditions.

UNIT IV Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms. Preventive measures – hygiene/sanitation, disinfestation of stores/receptacles, legal methods. Curative measures – non-chemical control measures – ecological, mechanical, physical, cultural, biological and engineering. Chemical control – prophylactic and curative – characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.

PRACTICAL

Collection, identification and familiarization with stored grains/seed insect pests and nature of damage caused by them; detection of insect infestation in stored food grains; estimation of losses in stored food grains; determination of moisture content in stored food grains; familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques; treatment of packing materials and their effect on seed quality. Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, IGSMRI, Hapur etc. (only where logistically feasible).

MAA Pateswari University, Balarampur,

M.Sc. (AG) Animal Husbandry and Dairying

Ist Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
AHD 501	Production & Management of Dairy Animals	3(2+1)	20	50	30	100
AHD 502	Poultry Production & Management	3(2+1)	20	50	30	100
AHD 503	Market Milk Technology	3(2+1)	20	50	30	100
AS 501	Agricultural Statistics	3(3+1)	20	50	30	100
TOTAL CREDIT		**12**				

II Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
AHD 504	Fundamental of Animal Nutrition	3(2+1)	20	50	30	100
AHD 505	Reproductive Physiology of Farm Animals	3(2+1)	20	50	30	100
AHD 506	Dairy Processing and plant management	3(2+1)	20	50	30	100
AHD 507	Feed Evaluation Techniques	3(3+1)	20	50	30	100
TOTAL CREDIT		**12**				

III Semester

S.No.	Course Title	Credit Hours	Marks.			
			Mid Term	Theory	Practical	Total
AHD 508	Microbiology of Milk & Milk Products	3(2+1)	20	50	30	100
AHD 509	Dairy Technology	3(2+1)	20	50	30	100
AHD 510	Fundamentals of Animal Breeding Genetics	3(2+1)	20	50	30	100
CA 502	Computer Application in Agriculture	2(1+1)	20	50	30	100
PGS 501	Library and Information Services (Non gradial) Satisfactory /unsatisfactory	1(0+1)	00	00	100	100
TOTAL CREDIT		**12**				

MAA Pateswari University, Balarampur,

IV-Semester

Code No.	Course Title	Credit Hours	
AHD-591	Master Seminar	1(0+1)	**Presentation**
AHD-599	Master Research (Thesis)	20	**Research**

OR

Special Paper (20 Credits) Satisfactory/ Unsatisfactory

			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
AHD 511	Non-Ruminant Nutrition	4(3+1)	20	50	30	100
AHD -520	Dairy Farm Management	4(3+1)	20	50	30	100
AHD -513	Ruminant Nutrition	4(3+1)	20	50	30	100
AHD -514	Technology of Indian dairy products	4(3+1)	20	50	30	100
AHD -515	Production & management of Sheep, Goat, Swine and Poultry	4(3+1)	20	50	30	100
		20				

Note- Passing marks in particular paper is 55%
Grade = Marks obtained in particular course divided by 10
The minimum grade point average (GPA) must be 5.5 in every semester
Pass : **5.5-5.99**
Second Division : **6.0-6.99**
First Division :**7.0-7.99**
First division with distinction : **8.0 and above**

MAA Pateswari University, Balarampur,

I Semester

AHD-501: PRODUCTION & MANAGEMENT OF DAIRY ANIMALS 3 (2+1)

Theory:

UNIT I: Development of livestock industry in India and world, Present status and future prospectus of livestock development in India Important Bread of Buffalo, Cattle, Sheep and Goat, treats of economic importance,

UNIT II: Housing and raring system, Breading management and method of breading pre nature and post nature care and management of cattle and buffalo, Management strategies for reducing mortality in calves, age at first calving and calving interval in cattle and buffalo.

UNIT III: Management of labour, Milking Management, Transport of Animal, Health Management (Important Diseases like FMD, HS, Timpanty, Impaction of Rumen, Dystocia milk fever, Ketosis).

UNIT IV: Feed and Fodder resources and there uses for feeding. Specific technique of feeding and watering. Computation of Practical and Economical Ration, Supply of Green Fodder, Around the Year, Enrichment of Poor-Quality Roughage.

Practical:

Identification of Animals, Handling and Restraining, Judging and Selection, Age Determination, Housing Management, Feeding & Nutrition, Milking Management, Breeding Management, Health Care Practices, Clean Milk Production, Farm Records.

MAA Pateswari University, Balarampur,

AHD-502: POULTRY PRODUCTION & MANAGEMENT 3 (2+1)

Theory:

UNIT I: Genetic Classification of Poultry Status of poultry industry in India, why poultry farming is too much important in our country Requirement of Protein, Energy, Vitamins, Minerals and Feed additives for layers and broilers.

UNIT II: Feed ingredients and ingredients related to energy, protein, minerals and vitamins sources Care and management of starters, growers, layers, broilers and breeding stocks. The formation of an egg and endocrine regulatory mechanism involved. Incubation and hatching of egg. Development of embryo in egg and Incubation.

UNIT III: Deworming and vaccination programmed, causal organism, symptoms, prevention and control of some important diseases like Ranikhet, Pullorum, Marck disease, Coccidiosis, C.R.D. Fowl pox and Coryza Principals of Bio security, Form Sanitization and disinfection procedure, Layout and design of Housing and cages.

Practical:

Neat and clean diagram of hen showing external body parts. structure of egg, Formulation of ration viz. Broiler starter ration, Broiler finisher ration. Chick starter ration, Grower ration, Layer ration and Breeder ration. Vaccination schedule for broiler and layers. Debeaking, Candling of eggs. Dissection of bird fir showing internal body parts.

MAA Pateswari University, Balarampur,

AHD-503: MARKET MILK TECHNOLOGY 3(2+1)

Theory

UNIT I: Recent advances in marketing of milk in India. Agencies involved in the production & handling of market milk Methods of procurement of milk, payments & quality assessment by organoleptic and platform test" Methods of chilling of milk and transportation.

UNIT II: Milk storage tanks, Maintenance and cleaning of equipment in receiving room and storage PTA standards for market milk, Preservatives commonly used in market milk Definition and technology of clean milk, safe milk, recombined milk, toned milk, filled milk and special milk production.

UNIT III: Importance of packaging of milk and different types of containers used, Recent advances in pricing and distribution of market milk, Problems of city milk supply.

Practical:

Assembling and dissembling of cream separator and separation of milk. Study of parts of LTLT and HTST pasteurizers, refrigeration plants and preparation of report. Preparation of special milks like toned milk, double toned milk, chocolate milk, sterilized milk, flavored and filled milk. Visits to milk plants and milk products factories and submission of the report. Numerical problems on the standardization of milk.

MAA Pateswari University, Balarampur,

AS 501- AGRICULTURAL STATISTICS 3(2+1)

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 distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distribution. 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 value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient, test of significance of correlation coefficient and regression coefficient, coefficient of determination**.**

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

UNIT V: Uniformity trials, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

UNIT VI: Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling. Estimation of proportion, confidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, non-sampling error-source and classification.

Practical:

To the study about CRD, RBD and LSD designs. Data analysis on correlation and regression on experimental data. Data presentation in bar and pie diagram.

MAA Pateswari University, Balarampur,

Semester II

AHD-504 Fundamental of Animal Nutrition 3 (2+1)

Theory:

UNIT I: Composition of Animal Body Digestive system of ruminant and non-ruminant animals, Ruminant Vs non-ruminant nutrition;

UNIT II: Digestion and metabolism of various nutrients like crude fiber, crude fat, crude protein, minerals, vitamins and NPN compounds in ruminant animals Evaluation of feed in relation to protein and energy value.

UNIT III: Nutrient requirements of farm animals like cattle and buffalo for various purposes like maintenance, growth, milk production, pregnancy, work and for service.

Practical: Relevant to concerned theory topics.

AHD-505: Reproductive Physiology of Farm Animals 3 (2+1)

Theory:

UNIT I: Anatomy of male and female reproductive tract. Physiology of endocrine mechanism involved in male reproduction such as sexual drive, spermatogenesis, hormones of testes, ejaculation and sperm transport Physiology and endocrine mechanism involved in female reproduction such as estrous cycle, oogenesis. ovulation and formation of corpusluteum (Physiology and endocrine mechanism involved in fertilization, implantation, maintenance of pregnancy, parturition, initiation and secretion of milk, let down and holding up of milk phenomena.

UNIT II: Physiology and endocrine mechanism involved in puberty, mammary gland development and maintenance of lactation.

Practical: Relevant to concerned theory topics

MAA Pateswari University, Balarampur,

AHD-506: Dairy Processing and plant management 3 (2+1)

Theory:

Processing of market milk pre-heating, filtration, clarification, purpose. principle, methods, homogenization, pasteurization, sterilization, uprization and bactofugation of milk. Cooling and storage of milk. Refrigeration and its importance in dairy industry; principles and systems of refrigeration, refrigerants; their uses and limitations, brine and its composition and maintenance Metals and materials commonly used in dairy industry, cleaning and sterilization of dairy utensils and equipment Requirements for dairy building constructions, importance of dairy plant layout. Factors to be considered in location of dairy plants, requirements, maintenance and upkeep of equipment for collection, transportation, storage, cooling, separation, homogenization, clarification, pasteurization and packaging of milk.

Practical: Relevant to concerned theory topics

AHD-507: Feed Evaluation Techniques 3 (2+1)

Theory:

Classification of feeding stuffs. composition of feed, weende vs soest methods of analysis. digestibility and metabolic trials for various classes of animal rumen fistula techniques, artificial rumen experimentation, in-vitro and in-vivo studies.

Practical: Relevant to concerned theory topics

MAA Pateswari University, Balarampur,

Semester III

AHD-508: Microbiology of Milk & Milk Products 3 (2+1)

Theory:

Micro-organism in milk. Milk as a nutrient's media, for bacterial growth, inhibitory substances in milk. Sources of contamination during production, handling and distribution of milk Important groups of bacteria occurring in milk. Thermoduric and thermophilic bacteria, activities of different species in milk principles involved in sanitary milk production. Routine bacteriological tests for quality control of market milk. Transmission of diseases of bovine and human origin through milk and milk products. Bacteriology of milk products, role of lactic acid bacteria and other micro-organisms in the manufacture of butter, cheese and fermented milk. Spoilage of various milk products by micro- organisms. Bacteriology of starter culture,

Practical: Relevant to concerned theory topics.

AHD-509: Dairy Technology 3 (2+1)

Theory:

Status of dairy industry in India. Operation flood programme technology mission on dairy National milk grid, marketing federation, their concept, achievement limitation and impact on the dairy industry in India. Recent policy changes to dairy sector (MMPO GATT) and their impact on dairy industry in India. Importance of various milk processing techniques, significance and role of indigenous dairy product in Indian Dairy Industry and economy Characteristics and composition of various indigenous products, their prospects and constraints. Basic principles of processing and quality aspect of different cream table half and half sterilized and high fat cream Quality aspect and safe life.

Practical: Relevant to concerned theory topics.

MAA Pateswari University, Balarampur,

AHD-510: Fundamentals of Animal Breeding Genetics 3 (2+1)

Theory:

Genetics Its importance in animal breeding. Mendelian laws and its modified ratios-gene interaction Lethal factor, qualitative & quantitative heredity linkage and its importance in livestock improvement, inheritance of sex linkage, sex influenced and sex Limited traits. Gene frequency, factors affecting gene frequency Breeding Inbreeding, its genotypic effect, measurement of relationship and coefficient of inbreeding Out crossing and its importance, selective vs cross breeding, heterosis in milk production traits, grading up and species hybridization Artificial insemination and its importance collection of semen, handling and evaluation of semen Dilation of semen, preservation and storage of semen, and insemination

Practical: Relevant to concerned theory topics

CA-502: Computer Application in Agriculture 2 (1+1)

Theory:

Introduction to computer, operating system, definition and types, application of MS-Office for document creation & editing, data presentation, interpretation, statistical analysis, mathematical expressions, database concepts and types, us of DBMS in Agriculture, World Wide Web (WWW), Memory, Hasic Army Computer System. e-Agriculture concepts and applications, Use of ICT in Agriculture 11 Application for computation of water and nutrient requirement of crops computer-controlled devices (automated system) for agri-input management, smart phone apps in Agriculture. Decision support systems, concepts components and applications in agriculture.

Practical:

Study of computer components, accessories, practice of important DOS Commands Introduction of different operating system such as window, files & folders, file management. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific document. MS-Excel - Creating a spreadsheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access-Creating database

MAA Pateswari University, Balarampur,

PGS- 501: Library and Information Services (Non Gradial Satisfactory /unsatisfactory) 1(0+1)

Practical:

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 abstract, CABI abstracts, etc.), Tracing information from reference sources Literature survey: Citation techniques/Preparation of bibliography: Use of CD-ROM Databases, Online Public Access Catalogne and other computerized library services; Use of Internal including search engines and its resources methods.

MAA Pateswari University, Balarampur,

Semester IV

AHD- 591 Master Seminar 1 (0+1) Master seminar topic or title related to animal husbandry & dairying would be decided by advisory committee.

AHD 599 Master Research (Thesis) 20 (0+20) Master research (thesis) topic or title related to animal husbandry & dairying would be decided by advisory committee.

OR Special Papers – (20-Credits) Satisfactory /Unsatisfactory

AHD-511: Non-Ruminant Nutrition 4 (3+1)

Theory:

The role of non-ruminant animals, study of their digestive tract. Monogastic animal nutrition in a historical perspective, carbohydrate. lipid and protein nutrition. translation of feeding standards into meal mixture. Physiological roles, deficiency symptoms and requirements of vitamins and minerals. Mode of action and effect of feed additives on animal performance. Feeding standards, methods of measuring the nutrient needs and efficiency of feed utilization.

Practical: Relevant to concerned theory topics.

HD-512: Dairy Farm Management 4 (3+1)

Theory:

Place of dairy farming in the national economy, consideration in establishment of a dairy farm enterprise, types and arrangements of dairy buildings, dairy housing and equipment Care and management of calves, heifers, lactating, dry and pregnant cows and buffaloes, dairy bulls and bullocks; forage production, feeding guides for various categories of dairy animals, tips of breeding efficiency management, herd health management, dairy record management and marketing by dairy animals and products.

Practical: Relevant to concerned theory topics.

MAA Pateswari University, Balarampur,

AHD 513: Technology of Indian Dairy products 4 (3+1)

Theory:

The role of ruminant animals, study of their digestive tract. Its development, rumen environment, ruminal movements, role of microbes and manipulation of rumen eco-system. Ingestion of food, passage of digestion through GIT, theories of regulation of feed intake digestion and metabolism of carbohydrates, nitrogenous compounds and lipids. Synthesis of lactose, glycerol, long chain fatty acids and non-essential amino-acids, composition of protein and its biological value. Study of problems associated with non-protein nitrogenous substances utilization. Water metabolism and requirements. Energy nutrition of rumen micro-organisms, manipulation of rumen fermentation, energy metabolism of host animal, host animal control of microbial fermentation and utilization of the energy of absorbed nutrients. Vitamin and mineral nutrition, function, metabolism, deficiency symptoms and their sources, inter-relationships between vitamins and minerals.

Practical:

Relevant to concerned theory topics.

AHD 514 Production and Management of sheep, Goat, swine & poultry 4 (3+1)

Theory:

Present trend of production of Indian dairy products. Comparison with Western dairy products. Concentrated products: definition, composition and method of preparation of khoa and rabri; Uses and keeping quality of khoa. Ghee composition, indigenous and improved practices of ghee making, grading of ghee under AGMARK. Coagulated milk products: definition, composition and methods of manufacture of chhena and paneer. Fermented milk products: definition, composition and method of preparation of Dahi, Srikhand, Yoghurt.

Practical: Relevant to concerned theory topics.

MAA Pateswari University, Balarampur,

AHD-515: PRODUCTION AND MANAGEMENT OF SHEEP, GOAT, SWINE & POULTRY 4(3+1)

Theory

Sheep & Goat- Important breeds of sheep & goat and their traits of economic importance, reproduction and breeding-system management in sheep & goat. Nutrients requirement and feeding practice for economic raising of sheep & goat. Routine operation. housing, care of kid & lamb, scope at intensive milk, meat, mutton & wool production. Low-cost shelter management of sheep & goat Health management package.

Swine-Piggery development programme in India. Characteristic of swine and their production. Breeds reproduction & their problems management, housing, nutrition, nutrients requirement and feeding of swine. Care & management of pregnant sow and unwanted piglet, future of pig production programme in India with special reference to weaker section of society.

Poultry- The digestive and reproductive system of fowl Formation of eggs Structure and nutritive value of egg. Egg producing carrier of a laying hen and factors affecting egg size. Abnormal eggs. Hatching of eggs. Management of incubator & light Breeding & rearing management of chick in brooders. Housing equipment housing requirements. Housing system of poultry Feeds. Method of feeding. Computation & mixing of ration. Use of agro-industrial by products in poultry feeding. Management of replacement pullets, culling of laying flocks. Maintenance of farms records Health & sanitation problem & their control. Strategy to promote back yard poultry farming commercial.

Practical: Relevant to concerned theory topics.

MAA Pateswari University, Balarampur,

Semester-wise distribution of courses

M.Sc. (Ag.) Agronomy

I-Semester			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
AGR-501	Modern Concept in Crop Production	3(2+1)	20	50	30	100
AGR-503	Principles and Practices of Weed Management	3(2+1)	20	50	30	100
AGR-506	Scientific Cultivation of Major Cereals and Pulses	3(2+1)	20	50	30	100
AS-501	Agricultural Statistics	3(2+1)	20	50	30	100
	TOTAL	12(8+4)				

II-Semester			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
AGR-502	Principles and Practices of Soil Fertilizers and Nutrient Management	3(2+1)	20	50	30	100
AGR-504	Principles and Practices of Water Management	3(2+1)	20	50	30	100
AGR-507	Scientific Cultivation of Oil Seeds, Fiber and Sugar Crops	3(2+1)	20	50	30	100
AGR-511	Cropping system and sustainable Agriculture	3(2+1)	20	50	30	100
	TOTAL	**12**				

III-Semester			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
AGR-509	Agronomy of Fodder and Forage Crops	3(2+1)	20	50	30	100
AGR-510	Agrostology & Agroforestry	3(2+1)	20	50	30	100
AGR-512	Dry Land Farming and Watershed Management	3(2+1)	20	50	30	100
CA-502	Computer Application in Agriculture	2(1+1)	20	50	30	100
PGS-501	Library and Information Services	1(0+1)	00	00	100	100
	TOTAL	**12**				

MAA Pateswari University, Balarampur,

IV-Semester

Code No.	Course Title	Credit Hours	
AGR-591	Master Seminar	1(0+1)	**Presentation**
AGR-599	Master Research (Thesis)	20	**Research**

OR

Special Paper (20 Credits) Satisfactory/ Unsatisfactory

			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
AGR - 513	Breeding for quality traits	4(3+1)	20	50	30	100
AGR. - 505	Gene regulation and expression	4(4+0)	40	60	00	100
AGR. - 508	Database management, evaluation and utilization of PGR	4(3+1)	20	50	30	100
AGR. - 514	Germplasm collection, exchange, quarantine	4(3+1)	20	50	30	100
AGR. - 515	Breeding Legumes, Oilseeds and Fiber Crops	4(3+1)	20	50	30	100
		20				

Note- Passing marks in particular paper is 55%
Grade = Marks obtained in particular course divided by 10
The minimum grade point average (GPA) must be 5.5 in every semester
Pass : **5.5-5.99**
Second Division : **6.0-6.99**
First Division :**7.0-7.99**
First division with distinction : **8.0 and above**

MAA Pateswari University, Balarampur,

I Semester

AGR – 501 MODERN CONCEPTS IN CROP PRODUCTION 3 (2+1)

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, milscherlich yield equation, its interpretation and applicability; baule unit.

UNIT-III

Effect of lodging in cereals; physiology of grains yields in cereals; optimization of plant population and planting geometry in relation to different resources.

UNIT-IV

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

UNIT-V

Integrated fanning systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming determining the nutrient needs for yield potentiality of crop plant; concept of balance nutrition and integrated nutrient management.

Practical:

- Study of growth analysis, Phases of growth yield analysis
- Study of agro-ecological zones
- Study of tillage, modern concept and related with course.

MAA Pateswari University, Balarampur,

AGR - 503 PRINCIPLES AND PRACTICES OF WEED MANAGEMENT 3 (2+1)

THEORY

UNIT-I

Weed biology and ecology, crop-weed competition including allelopathy; principles a method of weed control and Classification.

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.

UNIT-IV

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

UNIT-V

Integrated weed management; cost benefit analysis of weed management.

Practical

- Identification of important weeds of different crop.
- Preparation of awed herbarium
- Weed survey in crop and cropping systems
- Crop-weed competition studies
- Preparation of spray solution of herbicides for high and low-volume sprayers.
- Economics of weed control
- Herbicides resistance analysis in plant and soil.
- Calculation of herbicidal requirement

MAA Pateswari University, Balarampur,

AGR-506 SCIENTIFIC CULTIVATION OF MAJOR CEREALS AND PULSES 3 (2+1)

Theory

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.

UNIT-I

Rabi cereals; wheat, barley, oat

UNIT-II

Kharif cereals; Paddy, Maize, sorghum, bajra

UNIT-III

Rabi pulses; chickpea, field pea, lentil, rajma

UNIT-IV Kharif pulses: Arhar, Urd, Moong, Cowpea, Soyabean

Practical

- Phenological studies at different growth stages of crop
- Estimation of crop yield on basis of yield attributes
- Formulation of cropping schemes for various farm size and calculation of cropping and rotational intensities
- Planning and layout of field experiments
- Judging of physiological maturity in different crop
- Intercultural operations in different crops
- Determination of cost of cultivation of different crop
- Work out harvest index of various crops
- Study of seed production techniques in various crop
- Visit of field experiments on cultural, fertilizer weed control and water management aspects.

MAA Pateswari University, Balarampur,

AS - 501 AGRICULTURAL STATISTICS 3(2+1)

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 distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Test of significance based on Normal, chi-square, t and F distribution, large sample theory.

UNIT-III

Introduction to theory of estimation and confidence-intervals, correlation and regression, Simple and multiple linear regression model, estimation parameters, predicted value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient and regression coefficient, coefficient of determination.

UNIT-IV

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

UNIT-V

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing block design and Latin squire design, missing plot techniques, split plot design.

UNIT-VI

Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling. Estimation of proportion, **c**onfidence interval.

Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, non-sampling error-source and classification.

Practical: To the study about CRD, RBD and LSD designs. Data analysis on correlation and regression on experimental data. Data presentation in bar and pie diagram.

MAA Pateswari University, Balarampur,

II Semester

AGR - 502 PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT 3 (2 +1)

Theory

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.

UNIT - 2 Criteria of; essentiality of nutrients; essential plant nutrients - their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

UNIT - 3 Preparation and use of farmyard manure compost green manures, vermicompost, bio fertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management.

UNIT - 4 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 interaction.

UNIT-5 Time and method of manures and fertilizers applications; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops.

Practical:

Determination of soil pH, ECe. organic C, total N available NPK and S in soil. Determination of total N, P, K and S in plants. Numerical problems on fertilizers Requirement and fertilizer mixture.

MAA Pateswari University, Balarampur,

AGR – 504 PRINCIPLES AND PRACTICES OF WATER MANAGEMENT 3 (2+1)

Theory

UNIT - 1 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 - 2 Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress.

UNIT-3 Soil, plant and meteorological factors determining water needs of crop; scheduling., depth and methods of irrigation; micro- irrigation system; fertigation; management of water in controlled environments and polyhouses.

UNIT-4 Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation water use efficiency.

UNIT - 5 Excess of soil water and plant growth; water management in problem soils; drainage requirement of crop and methods of field drainage.

Practical: Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus. Soil-moisture characteristics curves. Water flow measurements using different devices. Determination of irrigation requirements. Calculation of irrigation efficiency.

MAA Pateswari University, Balarampur,

AGR – 507 SCIENTIFIC CULTIVATION OF OILSEED, FIBRE AND SUGAR CROPS 3 (2+1)

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrient management, handling and processing of the produce for maximum production of:

UNIT - 1 Rabi oilseeds - Rapeseed and mustard, linseed

UNIT - 2 Kharif oilseed - Groundnut, Til, Castor, Sunflower, Soyabean

UNIT - 3 Fiber crops - Cotton, Jute, Sun hemp.

UNIT-4 Sugar crop - Sugar-beet and Sugarcane

Practical: Planning-and layout of field experiments. Cutting of sugarcane setts. It's treatment and methods of sowing tying and propping of sugarcane. Intercultural operations in different crops. Cotton seed treatment. Judging of physiological maturity in different crops and workout harvest index. Work out cost of cultivation of different crops. Estimation of crop yield on the basis of yield attributes. Study of seeds production techniques in various crops. Visit of field experiments on cultural fertilizer, weed control and water management aspects.

MAA Pateswari University, Balarampur,

AGR – 511 CROPPING SYSTEM AND SUSTAINABLE AGRICULTURE 3 (2+1)

Theory

UNIT - 1 Cropping systems: Definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.

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.

UNIT-3 Above and below ground interactions and allelopathic effects; competition relations; multistoried cropping and yield stability in intercropping, role of non-monetary inputs and low-cost technologies; research need on sustainable agriculture.

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.

UNIT - 5 Plant ideotypes for drylands; plant growth regulators and their role in sustainability.

Practical: Related with the Course

MAA Pateswari University, Balarampur,

III Semester

AGR - 509 AGRONOMY OF FODDER AND FORAGE CROPS 3(2+1)

Theory:

UNIT -1 Area and distribution varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like maize, sorghum, bajra, cowpea, oats, barley, berseem, lucerne. Guar, etc.

UNIT - 2 Area and distribution, varietal improvement, agro-technique and quality aspects including anti-quality factors of important forage crops/grasses, napier grass, sudan grass, Rohdes grass, Deenanath grass, etc.

UNIT-3 Year - round fodder production and management, preservation and utilization of forage and pasture crops.

UNIT-4 Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor-quality fodder.

UNIT-5 Economics of forage cultivation uses and seed production techniques.

Practical: Practical raining of farm operation in raising fodder crops. Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops. Anti-quality components like HCN in sorghum and such factors in other crops. Hay and silage making and economics of their preparation. Field visit and identification of fodder and forage crops.

MAA Pateswari University, Balarampur,

AGR - 510 AGROSTOLOGY AND AGRO-FORESTRY 3(2+1)

Theory:

UNIT -1 Agrostology: definition and importance; principles of grassland ecology: grassland ecology - community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India: problems and management of grasslands.

UNIT - II Importance, classification (various criteria), scope, status and research need of pastures; pasture establishment, their improvement and renovation - natural pastures, cultivated pastures; common pasture grasses.

UNIT-III Agroforestry: definition and importance; agroforestry systems, agri-silviculture, silvipasture, agri-silvipasture, agri-horticulture, alley cropping and energy plantation.

UNIT-I V Crop production technology in agro-forestry and agrostology system; silvipastoral system: meaning and importance for wasteland development; selection of species, planting methods and problems of seed germination in agro-forestry systems; irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and underground interferences; lopping and coppicing in agro-forestry systems; social acceptability and economic viability, nutritive value of trees; tender operations; desirable tree characteristics.

Practical:

Preparation of charts and maps of India showing different types of pastures and agro-forestry systems. Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry. Seed treatment for better germination of farm vegetation. Methods of propagation/planting of grasses and trees in silvipastoral system. Fertilizer application in strip and silvipastorol systems. After-care of plantation. Estimation of total biomass and fuel wood. Economics of agro-forestry. Visit to important agro-forestry research stations.

MAA Pateswari University, Balarampur,

AGR - 512 DRY LAND FARMING AND WATERSHED MANAGEMENT 3(2+1)

Theory:

UNIT -1 Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

UNIT - II Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of droughts, characterization of environment for water availability: crop planning for erratic and aberrant weather conditions.

UNIT - III Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan lor aberrant weather conditions.

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.

UNIT-V Concept of watershed resource management, problems, approach and components.

Practical: Seed treatment, seed germination and crop establishment in relation to soil moisture contents. Moisture stress effects and recovery behavior of important crops. Estimation of moisture index and aridity index. Spray of anti-transpirants and their effect on crops. Collection and interpretation of data for water balance equations. Water use efficiency. Preparation of crop plants for different drought conditions. Study of field experiments relevant to dryland farming. Visit to dryland research stations and watershed projects.

MAA Pateswari University, Balarampur,

CA - 502 COMPUTER APPLICATION IN AGRICULTURE 2(1+1)

Theory:

Introduction to computer, operating system, definition and types, application of Ms-Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, database concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW); Memory, Basic Anatomy of Computer System. E-Agriculture concepts and applications, Use of ICT in Agriculture. IT Application for computation of water and nutrient requirement of crops, computer-controlled devices (automated system) for agri-input management, Smart phone Apps in Agriculture. Decision support systems, concepts, components and applications in agriculture.

Practical: Study of computer components, accessories, practice of important DOS Commands. Introduction of different operating system such as window, Files & Folders, File Management. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific document. MS-Excel - Creating a spread-sheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data, MS-Access- Creating database.

PGS-501 LIBRARY AND INFORMATION SERVICES 1(0+1)

Practical:

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 Internal including search engines and its resources; e-resources access methods.

MAA Pateswari University, Balarampur,

IV Semester

AGR 591: Master Seminar 1 (0+1) Presentation on relevant topic of concerned discipline

AGR 599: Master Research (Thesis) 20 (0+20) Perform research work and thesis writing on topic or title related to discipline of Horticulture.

AGR- 513 PRINCIPLES AND PRACTICES OF ORGANIC FARMING 4(3+1)

Theory:

UNIT-I Agro-meteorology-aim, scope and development in relation to crop environment; com position of atmosphere, distribution of atmospheric pressure and wind.

UNIT-II Characteristics of solar radiation; energy balance of atmosphere system; radiation distribution in plant canopies, radiation utilization by field crops; photosynthesis and efficiency of radiation utilization by field crops; environmental temperature: soil, air and canopy temperature.

UNIT - III Temperature profile in air, soil, crop canopies: soil and air temperature effects on plant processes; environmental moisture and evaporation: measures of atmospheric temperature and relative humidity, vapour pressure and their relationships; evapo-transpiration and meteorological factors determining evapotranspiration.

UNIT-IV Monsoon: monsoon and their origin, characteristics of monsoon; onset, progress and withdrawal of monsoon.

UNIT-V Weather forecasting in India- short, medium and long-range forecasting; benefits of weather services to agriculture, Remote Sensing application in agriculture and its present status in India; atmospheric pollution and its effect on climate and crop production; climate change and its impact on agriculture.

Practical: Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure. Measurement/estimation of evapo-transpiration by various methods. Measurement/estimation of soil water balance. Rainfall variability analysis. Determination of heat-unit requirement for different crops. Measurement of crop canopy temperature Measurement of soil temperatures at different depths. Remote sensing and familiarization with agro-advisory service bulletins. Study of synoptic charts and weather reports, working principle of automatic weather station. Visit to solar observatory.

MAA Pateswari University, Balarampur,

AGR- 508 AGRONOMY OF MEDICINAL, AROMATIC AND UNDERUTILIZED CROPS 4(3+1)

Theory:

UNIT -I Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and uses.

UNIT-II Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Rauwolfia, Aloe Vera, Satavar, Safed Musli, Ashwagandha, etc).

UNIT-III Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil (Tulsi), Lemon grass, Rose, etc.).

UNIT - IV Climate and soil requirements; cultural practices; yield of under-utilized crops (Lathyrus, Sesbania, Cluster bean, French bean. Fenugreek, Tea and Tobacco).

Practical: Identification of crops based on morphological and seed characteristics. Raising of herbarium of medicinal, aromatic and under-utilized plants. Quality characters in medicinal and aromatic plants. Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.

MAA Pateswari University, Balarampur,

AGR - 514 CROP PRODUCTION IN PROBLEMATIC SOILS 4(3+1)

Theory:

UNIT-I Problem soils and their distribution in India; acid, saline and waterlogged soils, origin of problematic soils and factors responsible.

UNIT-II Response of crop to acidity, salinity, sodicity, excess water and nutrient imbalance.

UNIT - III Reclamation of problem soils, role of amendments and drainage. Lime requirement for acid soils and gypsum requirement for sodic soils.

UNIT-IV Crop production techniques in problem soils-crops, varieties, cropping system and agronomic practices.

UNIT - V Effects of water table fluctuation on crop growth. Degraded lands and their rehabilitation.

Practical: Characterization of acid, salt affected and calcareous soils. Lime requirement of acid soils. Gypsum requirement of Sodic Soils. Determination of cations (Na+, K+, Ca++, and Mg++,) in soil samples Determination of anions (Cl, So4, Co3) in soil samples. Reclamation of problem soils by agronomic practices.

MAA Pateswari University, Balarampur,

AGR - 515 Diagnosis of Nutritional Deficiency in Field Crops and their Remedial Measure 4(3+1)

Theory:

Deficiency symptoms of individual elements - macro, micro exhibited by cereals, oilseeds, pulses, fibre crops, forage crops, sugar crops, tuber crops, causes of deficiency, physiological changes brought about in plants due to deficiency. Plants parts showing the symptoms critical level of nutrient elements of deficiency, indicator plants for different elements. Toxicity limits of different elements. Toxicity systems. Prevention alleviation of deficiency toxicity, similarity of deficiency symptoms with disease symptoms.

Practical: Principles of colorimetry. Flame-photometry and atomic absorption spectroscopy. Chemical analysis of soil for total and available nutrients. Analysis of plants for essential elements.

MAA Pateswari University, Balarampur,

M.Sc. (Ag.) Horticulture

I-Semester			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
HORT-501	Propagation and Nursery Management for Fruit Crops	3(2+1)	20	50	30	100
HORT-502	Landscaping and Ornamental Gardening	3(2+1)	20	50	30	100
HORT-503	Tropical and Dry Land Fruit Production	3(2+1)	20	50	30	100
AS-501	Agricultural Statistics	3(2+1)	20	50	30	100
	TOTAL	**12**				

II-Semester			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
HORT-504	Production Technology of Cool Season Vegetable Crops	3(2+1)	20	50	30	100
HORT-505	Subtropical and Temperate Fruit Production	3(2+1)	20	50	30	100
HORT-506	Production Technology of Cut and Loose Flowers	3(2+1)	20	50	30	100
HORT-507	Protected Cultivation of Horticultural Crops	2(1+1)	20	50	30	100
	TOTAL	**11**				

III-Semester			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
HORT-508	Production Technology of Warm Season Vegetable Crops	3(2+1)	20	50	30	100
HORT-509	Breeding of Horticultural Crops	3(2+1)	20	50	30	100
HORT-510	Post -Harvest Technology of Horticultural Crops	3(2+1)	20	50	30	100
CA-502	Computer Application in Agriculture	2(1+1)	20	50	30	100
	TOTAL	**11**				

MAA Pateswari University, Balarampur,

IV-Semester			
Code No.	**Course Title**	**Credit Hours**	
HORT-591	Master Seminar	1(0+1)	**Presentation**
HORT-599	Master Research (Thesis)	20	**Research**

OR

Special Paper (20 Credits) Satisfactory/ Unsatisfactory

			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
HORT-511	Fruit Technology	4(3+1)	20	50	30	100
HORT-512	Production Technology of Medicinal and Aromatic Crops	4(3+1)	20	50	30	100
HORT-513	Production Technology of Plantation & Spices Crops	4(3+1)	20	50	30	100
HORT-513	Advance Horticulture	4(3+1)	20	50	30	100
HORT-513	Production Technology of under - utilize Sub-tropical Crops	4(3+1)				
		20				

Note- Passing marks in particular paper is 55%
Grade = Marks obtained in particular course divided by 10
The minimum grade point average (GPA) must be 5.5 in every semester
Pass : **5.5-5.99**
Second Division : **6.0-6.99**
First Division :**7.0-7.99**
First division with distinction : 8.0 and above

MAA Pateswari University, Balarampur,

I-Semester

HORT-501 Propagation and Nursery Management for Fruit Crops 3(2+1) Theory

UNIT-I

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixes, polyembryony, chirmeras**.** Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth.

UNIT-II

Seed quality treatment, packing, storage, certification, testing, Asexual propagation-rooting of soft and hard cutting under mist by growth regulators. Rooting of cuttings in hotbeds, Physiological, anatomical and biochemical aspects of root Induction in cuttings. Layering — principle and method.

UNIT-III

Budding and grafting, selection of site mother plants, methods.

Establishment of bud wood bank, stock, scion and inter stock relationship-incompatibility. Rejuvenation through top Working-Progeny orchard and scion bank.

UNIT-IV

Micro propagation-principles and concepts, commercial exploitation in horticultural crops. Techniques-in vitro clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture, Hardening, packing and transport of micro- propagules.

UNIT-V

Nursery-types, structures, components, planning and layout. Nursery management practices for healthy propagate production.

PRACTICAL

Anatomical studies in rooting of cutting and graft union, construction of propagation structure, study of media and PGR, Hardening -case studies, micro propagation, explant preparation, media preparation, culturing in vitro clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct organogenesis and indirect organogenesis. direct and indirect embryogenesis, micro grafting, hardening, visit to TC labs and nurseries.

MAA Pateswari University, Balarampur,

HORT 502 Landscaping and Ornamental Gardening 3(2+1)

Theory

UNIT- I

Landscape designs, types of gardens, English, Moghul, Japanese, Persian, Spanish, Italian, Vanams, Buddha Garden, Styles of garden, formal, informal and free style garden.

UNIT-II

Urban landscaping, Landscaping for specific, situations, institutions, industries, resident, hospitals, roadsides, traffic islands, domestics, IT parks, corporates.

UNIT-III

Garden plant components, arboretum, shrubbery, fernery, palmarum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

UNIT-IV

Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, rock garden, clock garden, Colour
wheels, temple garden sacred groves.

UNIT-V

Bio-aesthetic planning, eco-tourism, theme park, indoor gardening, therapeutic gardening, on-plant components, water scraping, xeriscaping, hardscaping

PRACTICAL

Selection of Ornamental plants, practice in preparing designs for home gardens, industrial gardens institutional gardens, corporates avenue planting, and practice in planning and planting of special type of gardens, bur lapping, lawn making, planting herbaceous and shrubbery borders, project preparation on landscaping for different situation, visit to parks and botanical gardens cash study on commercial landscape gardens.

MAA Pateswari University, Balarampur,

HORT-503 Tropical and Dry Land Fruit Production Credit 3(2+1)

Theory

Commercial varieties of regional, national and international importance, Eco physiological requirements recent trends propagation rootstock influence planting system, cropping system, root zone and canopy management, nutrient management, water management, fertigation role of bioregulators abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, pest and diseases management physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri. Export zones (AEZ) and industrial supports. **UNIT I-** Mango and Banana

UNIT II- Citrus and Papaya

UNIT III- Guava, Sapota and Jackfruit

UNIT IV- Pineapple, Annona's and Avocado

UNIT V- Aonla, Pomegranate, Phalsa and Ber & minor fruits of tropics.

PRACTICAL

Identification of important cultivars, observations on growth and development practices in growth regulation, malady diagnosis, analyses of
quality attributes, visit to tropical und arid zone orchards, Project preparation for establishing commercial orchards.

MAA Pateswari University, Balarampur,

AS - 501 AGRICULTURAL STATISTICS 3(2+1)

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 distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Test of significance based on Normal, chi-square, t and F distribution, large sample theory.

UNIT - III

Introduction to theory of estimation and confidence-intervals, correlation and regression, Simple and multiple linear regression model, estimation parameters, predicted value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient and regression coefficient, coefficient of determination.

UNIT-IV

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

UNIT-V

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing block design and Latin squire design, missing plot techniques, split plot design.

UNIT-VI

Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling. Estimation of proportion, confidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, non-sampling error-source and classification.

Practical: To the study about CRD, RBD and LSD designs. Data analysis on correlation and regression on experimental data. Data presentation in bar and pie diagram.

MAA Pateswari University, Balarampur,

Semester II

HORT-504: [Production Technology of Cool Season Vegetable Crops] 3(2+1)

Theory: Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate end seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post- harvest management, plant protection measures and seed production of:

UNIT I: Potato

UNIT II: Cole crops- Cabbage, Cauliflower, Knol kohl, Sprouting broccoli, Brussels sprout UNIT III: Root crops- Carrot, Radish, Turnip and Beetroot

UNIT IV: Bulb crops- Onion and Garlic.

UNIT V: Peas and Broad bean, green leafy cool season vegetables

Practical:

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economic; Experiments to demonstrate the role of mineral elements, plant growth substances end herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/polyhouse.

MAA Pateswari University, Balarampur,

HORT-505: [Subtropical and Temperate Fruit Production] 3(2+1)

Theory:

Commercial varieties of regional, national and international importance. Eco physiological requirements, recent trends in propagation, rootstock influence, planting systems cropping systems, root zone and canopy management, nutrient management, water management, fertigation bio regulation, abiotic factors, limiting fruit production, physiology of flowering, fruit set and development abiotic factors limiting production. Physiological disorder-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri Export Zone (AEZ) and industrial support.

UNIT I: Apple, pear, quince, grapes

UNIT II: Plums, peach, apricot, cherries, hazelnut

UNIT III: Litchi, loquat, persimmon, kiwifruit, strawberry UNIT IV: Nuts-walnut, almond, pistachio, peanut

UNIT V: Minor fruits-mangosteen, carambola, bail, wood apple, fig, jamun, rambutan, pomegranate

Practical:

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical subtropical, humid, tropical and temperate orchards, Project preparation for establishing commercial orchards.

MAA Pateswari University, Balarampur,

HORT-506: [Production Technology of Cut and Loose Flowers] 3(2+1)

Theory:

UNIT I: Scope of cut and loose flowers in global trade, Global Scenario of cut and loose flower production. Varietal wealth and diversity, area under cut and loose flowers and production problems in India-Patent rights, nursery management, media for nursery, special nursery practices.

UNIT II: Growing environment, open cultivation of cut and loose flower, soil requirements, field preparation, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO2, on growth and flowering.

UNIT III: Flower production - water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

UNIT IV: Flower forcing and year-round flowering through physiological interventions, chemical regulation, environmental manipulation.

UNIT V: Cut flower standards and grades, harvest indices, harvesting techniques. Post- harvest handling. Methods of delaying flower opening, prolonging self-life, pre-cooling pulsing packing Storage & transportation, marketing, export potential, institutional support. Agri Export Zones. Crops: Rose, chrysanthemum, carnation, gerbera, gladioli tuberose, orchids, anthurium, aster, liliums, as cut flower nyctanthes, jaismine, marigold, crosandra, celosia, amplirena as loose flower.

Practical:

Botanical description of varieties, propagation techniques, mix chamber operation, training and pruning techniques, practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, post-harvest handling, cold chain, project preparation for regionally important cut and loose flowers, visit to commercial flower units and case study.

MAA Pateswari University, Balarampur,

HORT-507: [Protected Cultivation of Horticultural Crops] 2(1+1)

Theory:

UNIT I: Importance and scope of protected cultivation, world scenario, Indian situation, present and future scope. Principles used in protected cultivation, energy management, low-cost structures.

UNIT II: Regulatory structures used in protected structure, types of greenhouse/polyhouse/net house, hot beds, cold frames, effect of environmental factors viz temperature, light. CO2 and humidity on growth of different vegetables, flowers and fruits, manipulation of CO2 light and humidity and temperature for production of horticultural crops, installation of micro irrigation and fertilization.

UNIT III: Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

UNIT IV: Regulation of flowering and fruiting in horticultural crops, technology for raising tomato, sweet pepper, cucumber crops. Gerbera, chrysanthemum and straw berry in protected structures, training and staking in protected crops, varieties and hybrids suitable for growing in protected structures.

Unit V: Problems of growing horticultural crops in protected structures and their remedies. Insect and disease management in protected structures.

Practical:

Study of various types of structures, methods to control temperature, CO, and light, media, training and pruning, fertigation and nutrient management, control of insect-pests and disease in greenhouse; economics of protected cultivation, visit to established green/polyhouse/net house/shade house in the region.

MAA Pateswari University, Balarampur,

Semester III

HORT-508: [Production Technology of Warm Season Vegetable Crops] 3(2+1)

Theory:

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutrition and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures, economies of crop production and seed production of:

UNIT I: Okra, Cowpea and Cluster bean

UNIT II: Cucurbitaceous crops like Musk Melon, Cucumber and Bitter gourd

UNIT III: Sweet Potato

UNIT IV: Green leafy warm season vegetables like Spinach and Amaranthus

Practical:

Cultural operations (fertilizer application, sowing, mulching irrigation, weed control) of summer vegetable crops and their economies, study of physiological disorders and deficiency of mineral elements, preparation of cropping schemes for commercial farms, experiments to demonstrate the role of mineral elements, physiological disorders. plant growth substances and herbicides; seed extraction techniques, identification of important pests and diseases and their control; maturity standards, economics of warm season vegetable crops.

MAA Pateswari University, Balarampur,

HORT 509: [Breeding of Horticultural Crops] 3(2+1)

Theory:

Origin, botany, taxonomy, genetics, breeding objectives, breeding methods (introduction, selection and hybridization) varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, issue of patenting, PPVFR act, achievement and future trust in following selected crops.

UNIT I: Tomato, Brinjal and Chilli UNIT II: Okra and Pumpkin

UNIT III: Cabbage, Cauliflower, Carrot, Turnip and Radish

Practical:

Selection of desirable Plants from breeding population, observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generation: induction of flowering, palynological studies, selfing and crossing techniques in horticulture crops, hybrid seed production of vegetable crops in bulk, screening techniques for insect. pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population, visit to breeding blocks.

MAA Pateswari University, Balarampur,

HORT 510: [Post Harvest Technology of Horticultural Crops] 3(2+1)

Theory:

UNIT I: Maturity indices, harvesting practices for specific market requirements, influence of pre- harvest practices, enzymatic and textural changes, respiration and transpiration.

UNIT II: Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management factors leading to post harvest losses horticultural crops pre-cooling Spoilage, microbial and biochemical, physical injuries and disorders.

UNIT III: Temperature prior to transportation, viz grading, precooling, chlorination, waxing, chemicals, bio control agent and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, Zero energy cool chamber and hypobaric storage.

UNIT IV: Packaging method and transport, principles and methods of preservation food processing, canning preparation of fruits juices, beverages, pickles, jam, jellies, candies and tomato products.

UNIT V: Dried and dehydrated products, nutritionally enriched products, fermented beverages, packaging technology, management of processing waste, food safety standards.

Practical:

Analyzing maturity stages of commercially important horticultural crops, improved packaging and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate. Ethylene release and study of vase life extension in cut flowers using chemicals, estimation of quality characteristics in stored fruits and vegetables, cold chain management, visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.

MAA Pateswari University, Balarampur,

CA 502- [Computer Application in Agriculture] 2(1+1)

Theory:

Introduction to computer, operating system, definition and types, application of Ms-Office for document creation & editing, data presentation, interpretation and graph creation, statistical analysis, mathematical expression, database concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW); Memory, Basic Anatomy of Computer System. e-Agriculture concepts and applications. Use of ICT in Agriculture. IT application for computation water and nutrient requirement of crops, computer-controlled devices (automated systems) for agri-input management, Smart phone Apps in Agriculture. Decision support systems, concepts, components and applications in agriculture.

Practical:

Study of computer components, accessories, practice of important DOS Commands, introduction of different operating system such as window, files & folders, File Management. Use of MS- Word and MS Power point for creating, editing and presenting a scientific document. MS-Excel - Creating a spread sheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access Creating database

MAA Pateswari University, Balarampur,

SEMESTER IV

HORT 591: Master Seminar 1 (0+1) Presentation on relevant topic of concerned discipline

HORT 599: Master Research (Thesis) 20 (0+20) Perform research work and thesis writing on topic or title related to discipline of Horticulture.

HORT 511: [Fruit Technology (Special Paper)] 4(3+1)

Theory:

UNIT I: History, present position and future scope of fruit and vegetables preservation industries in India. General principles of fruit and vegetables preservation.

UNIT II: Canning and bolting of fruit vegetables, brief history of scientific canning, equipment for home canning and commercial production, important consideration for laying out of canning. Canning of important fruits, vegetables, spoilage in canned fruits and vegetables.

UNIT III: Fruits and vegetables juices, unfermented beverages (sweetened and unsweetened), principles of preservation, home and commercial scale equipment for juices, preparation and preservation of juices, squashes and cordials from Citrus fruits. Mango, Phalsa, Jamun, Grape, Pomegranate Tomato etc Fruit juice concentrates and their general method of preparation

UNIT IV: Jams, Jellies and Marmalades, role of pectin-sugar and acid in jelly formation. general method of preparation of jams, jellies and marmalades, use of jelly meter etc. Equipment for home and commercial production.

UNIT V: Pickles, sauces, chutney and vinegar, Potato chips general principles, equipment and method of preparation, preserve, candy and canes fruits, general principles and method of preparation of by product from fruit and vegetables waste in home and commercial production and sun drying and dehydration of fruit and vegetables, equipment and methods.

Practical:

1- List of important equipment for fruit and vegetable preservation. 2- Preparation of Jam, Jelly, Marmalade and Pickles (Mango, Lime and Mix Veg). 3- Preparation of Beverages (RTS, Squash, Nectar, Syrup and Barley Water). 4- Preparation of preserve and candy (Aonla, Bael and Karaunda). 5- Preparation of Tomato products (Sauce, Ketchup and Chutney). 6- Preparation of Potato Chips and canning of Pea.

MAA Pateswari University, Balarampur,

HORT 512: [Production Technology of Medicinal and Aromatic Crops (Special Paper)] 4(3+1)

Theory:

UNIT I: Importance and scope of medicinal and aromatic crops in India and future prospects, classification of medicinal and aromatic crops.

UNIT II: Cultivation of medicinal crops like Rauvolfia, Andrographis, Aloe- vera, Safed musli, Isabgol, Ashwagnadha, Bacopa and Asparagus.

UNIT III: Cultivation of aromatic crops like Mentha, Java citronella, Khus, Ocimum, Chamomile, Lemon grass, Geranium, Palmarosa and Rose.

UNIT IV: Special problems of medicinal and aromatic crops and their control.

UNIT V: Different method of distillation of medicinal and aromatic crops, problems of distillation and their solution. Marketing of medicinal and aromatic crops.

Practical:

Identification of medicinal and aromatic crops. 2- Study of propagation techniques of medicinal and aromatic crops. 3- Study of cost of production of Rauvolfia, Aloevera, Safed musli, Mentha, Turmeric and Ginger. 4- Study of different methods of distillation of medicinal aromatic plants. 5- Visit of distillation plants and institute related to medicinal and aromatic crops.

MAA Pateswari University, Balarampur,

HORT 513: [Production Technology of Plantation and Spices Crops (Special Paper)] 4(3+1)

Theory:

UNIT I: Importance and scope of plantation and spices crop in India, its area and distribution.

UNIT II: Production technology of plantation crops like, coconut, areca nut, cashew nut. Tea, cocoa and coffee.

UNIT III: Production technology of spices crops like, Turmeric, Zinger Cumin, Coriander, Fennel, Blackpeper, Cardamom (Large and small).

UNIT IV: Problems of plantation and spices crops and their remedies. Marketing, post- harvest management and storage of plantation and spices crops.

UNIT V: Problems of plantation and spices crops and their remedies, marketing, post- harvest management and their storage of plantation and spice crops.

Practical:

Identification of plantation and spice crops. 2- Propagation method of plantation crops. 3- Preparation of nursery for plantation. 4- Calculation of cost of production per hectare of spices crops, Turmeric, Zinger, Coriander and Cumin.

MAA Pateswari University, Balarampur,

HORT 514- [Advance Horticulture (Special Paper)] 4(3+1)

Theory:

UNIT I: Introduction and important mechanization of nursery, micro propagation of horticultural crops. Advantage and limitations, types of culture (Seed, Embryo, organ, callus and cell).

UNIT II: Advance made in root stocks, development of root stocks for biotic and abiotic stress.

UNIT III: Advances in irrigation system, advantage and disadvantage of drip irrigation, sprinkler and rain gun.

UNIT IV Canopy management of tropical and subtropical fruit crops like Mango, Guava, Grapes, Ber and Bael.

UNIT V Special problems of fruit crops and their control (Mango Guava, Papaya, Grapes, Pine apple and Apple), High density orcharding in fruits crops.

Practical:

Identification and use of equipment's in tissue culture laboratory. 2- Sterilization technique of media. 3- Identification and application of tools and equipment related to micro-irrigation system and canopy management. 4- Identification of special problems of fruit crops.

MAA Pateswari University, Balarampur,

HORT 515: [Production technology of underutilize Sub-tropical fruits (Special Paper)] 4(3+1)

Theory:

UNIT I: Importance and scope of underutilize fruits in India. Distribution and description of underutilize fruits.

UNIT II: Production techniques of underutilize fruits subtropical fruits like Bael, Custard apple, Wood apple, Barbados cherry, Citrus, Grapes, Litchi, Ber, Loquat, Phalsa, Fig, Mulberry, Karonda and Aonla.

UNIT III: Propagation technique of underutilize fruits, sexual and asexual including micro-propagation.

UNITIV: Problem of underutilize fruits and then remedies.

UNIT V: Marketing Post harvest management and storage of underutilize fruits.

Practical:

1- Identification of underutilize fruits 2- Propagation of underutilize fruits 3- Filling and lifting of polybags. 4- Packaging and sapling. 5- Visit of research centers working on underutilize fruits

MAA Pateswari University, Balarampur,

M.Sc. (Ag.) Soil Science and Agriculture Chemistry

I-Semester			Evaluation mark			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
SSAC-504	Soil Minerology, Genesis, Classification & Survey	3(2+1)	20	50	30	100
SSAC-509	Soil, Water & Air Pollution	3(2+1)	20	50	30	100
SSAC-511	Analytical Techniques & Instrumental Methods in Soil & Plant Analysis	2(0+2)	-----	------	100	100
AS-501	Agricultural Statistics	3(2+1)	20	50	30	100
	TOTAL	11(6+5)				

II-Semester			Evaluation mark			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
SSAC- 501	Soil Physics	3(2+1)	20	50	30	100
SSAC- 502	Soil Fertility and Fertilizers use	4(2+1)	20	50	30	100
SSAC- 503	Soil Chemistry	3(2+1)	20	50	30	100
SSAC- 506	Soil Biology & Biochemistry	3(2+1)	20	50	30	100
	TOTAL	**13**				

III-Semester			Evaluation mark			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
SSAC- 505	Soil Erosion and conservation	3(2+1)	20	50	30	100
SSAC- 510	Remote Sensing & GIS Techniques for Soil, Water and Crop Studies	3(2+1)	20	50	30	100
SSAC- 513	Management of Problematic Soils & Waters	3(2+1)	20	50	30	100
CA-502	Computer Application in Agriculture	2(1+1)	20	50	30	100
PGS-501	Library and Information Service	1(0+1)	00	00	100	100
	TOTAL	**12**				

MAA Pateswari University, Balarampur,

IV-Semester			
Code No.	**Course Title**	**Credit Hours**	
SSAC-591	Master Seminar	1(0+1)	**Presentation**
SSAC-599	Master Research (Thesis)	20	**Research**

OR

Special Paper (20 Credits) Satisfactory/ Unsatisfactory

			Evaluation marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term**	**Theory**	**Practical**	**Total**
SSAC-514	Advanced Organic Chemistry & Plant Biochemistry	4(3+1)	20	50	30	100
SSAC-515	Advanced Bio-pesticides & Bio-Fertilizers	4(3+1)	20	50	30	100
SSAC-516	Soil Physical Environment and Plant Growth	4(3+1)	20	50	30	100
SSAC-517	Soil Testing, Water Quality and fertilizer Recommendations	4(3+1)	20	50	30	100
SSAC-518	Modeling Soil Plant System	4(3+1)	20	50	30	100
		20				

Note- Passing marks in particular paper is 55%
Grade = Marks obtained in particular course divided by 10
The minimum grade point average (GPA) must be 5.5 in every semester
Pass : **5.5-5.99**
Second Division : **6.0-6.99**
First Division :**7.0-7.99**
First division with distinction : **8.0 and above**

MAA Pateswari University, Balarampur,

I-Semester

SSAC- 504 Soil Minerology, Genesis, Classification & Survey 3(2+1)

Theory

UNIT-I

Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism. Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate minerals and their identification; clay minerals in Indian soils.

UNIT-II

Factors of soil formation, soil formation models; soil forming processes; weathering of rocks and mineral transformations; soil profile; weathering sequences of minerals with special reference to Indian soils.

UNIT-III

Concept of soil individual; soil classification systems – historical developments and modern systems of soil classification with special emphasis on soil taxonomy; soil classification, soil mineralogy and soil maps – usefulness.

UNIT-IV

Soil survey and its types; soil survey techniques - conventional and modern; soil series – characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; soil mapping, thematic soil maps, cartography, mapping units, techniques for generation of soil maps.

UNIT-V

Landform – soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT) – concept and application; approaches for managing soils and landscapes in the framework of agro-ecosystem.

Practical

- Identification and quantification of minerals in soil fractions.
- Morphological properties of soil profile in different landforms.
- Classification of soils using soil taxonomy.
- Calculation of weathering indices and its application in soil formation.
- Grouping soils using available data base in terms of soil quality.

- Aerial photo and satellite data interpretation for soil and land use.
- Cartographic techniques for preparation of base maps and thematic maps, processing of field sheets, compilation and obstruction of maps in different scales.
- Land use planning exercises using conventional and RS tools

MAA Pateswari University, Balarampur,

SSAC-509 Soil, Water & Air Pollution 3(2+1)

Theory

UNIT-I

Soil, water and air pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

UNIT-II

Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms.

UNIT-III

Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health.

UNIT-IV

Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases – carbon dioxide, methane and nitrous oxide.

UNIT-V

Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.

Practical

- Sampling of sewage waters, sewage sludge, solid/liquid industrial wastes, polluted soils and plants
- Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD).
- Nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents.
- Heavy metals in contaminated soils and plants.
- Management of contaminants in soil and plants to safeguard food safety.
- Air sampling and determination of particulate matter and oxides of Sulphur.
- Visit to various industrial sites to study the impact of pollutants on soil and Plants.

MAA Pateswari University, Balarampur,

SSAC- 511 Analytical Techniques & Instrumental Methods in Soil & Plant Analysis 2(0+2)

Practical

UNIT-I

Preparation of solutions for standard curves, analytical reagents, qualitative reagents, indicators and standard solutions for acid-base, oxidation reduction and complexometric titration; soil, water and plant sampling **t**echniques, their processing and handling.

UNIT-II

Determination of nutrient potentials and potential buffering capacities of soils for phosphorus and potassium; estimation of phosphorus, ammonium and potassium fixation capacities of soils.

UNIT-III

Principles of visible, ultraviolet and infrared spectrophotometery, atomic absorption, flame-photometry, inductively coupled plasma spectrometry; chromatographic techniques, mass spectrometry and X-ray defractrometery; identification of minerals by X-ray by different methods.

UNIT-IV

Electrochemical titration of clays; determination of cation and anion exchange capacities of soils; estimation of exchangeable cations (Na, Ca, Mg, K); estimation of root cation exchange capacity.

UNIT-V

Analysis of soil and plant samples for N, P, K, Ca, Mg, S, Zn, Cu, Fe, Mn, B and Mo; analysis of plant materials by digesting plant materials by wet and dry ashing and soil by wet digestion methods.

UNIT-VI

Determination of lime and gypsum requirement of soil; drawing normalized exchange isotherms; measurement of redox potential.

UNIT-VII

Analysis of soil extracts and irrigation waters for their soluble cations and anions and interpretation of results. Plant Analysis.

MAA Pateswari University, Balarampur,

AS - 501AGRICULTURAL STATISTICS 3(2+1)

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 distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Test of significance based on Normal, chi-square, t and F distribution, large sample theory.

UNIT - III

Introduction to theory of estimation and confidence-intervals, correlation and regression, Simple and multiple linear regression model, estimation parameters, predicted value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient and regression coefficient, coefficient of determination.

UNIT-IV

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

UNIT-V

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing block design and Latin squire design, missing plot techniques, split plot design.

UNIT-VI

Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, **c**onfidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, non-sampling error-source and classification.

Practical: To the study about CRD, RBD and LSD designs. Data analysis on correlation and regression on experimental data. Data presentation in bar and pie diagram.

MAA Pateswari University, Balarampur,

Semester II

SSAC-501: Soil Physics 3(2+1)

Objective: To impart basic knowledge about soil physical properties and processes in relation to plant growth.

Theory

Unit I: Scope of soil physics and its relation with other branches of soil science; soil as a three-phase system. Unit II: Soil texture, textural classes, mechanical analysis, specific surface.

Unit III: Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts.

Unit IV: Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting - mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation.

Unit V: Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil moisture characteristic curve; hysteresis, measurement of soil-moisture potential.

Unit VI: Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils.

Unit VII: Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum.

Unit VIII: Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management. Unit IX: Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

MAA Pateswari University, Balarampur,

Practical

➢ Mechanical analysis by pipette and international methods. ➢ Measurement of Atterberg limits ➢ Aggregate analysis - dry and wet ➢ Measurement of soil-water content by different methods ➢ Measurement of soil-water potential by using tensiometer and gypsum blocks ➢ Determination of soil-moisture characteristics curve and computation of pore-size distribution ➢ Determination of hydraulic conductivity under saturated and unsaturated conditions ➢ Determination of infiltration rate of soil ➢ Determination of aeration porosity and oxygen diffusion rate ➢ Soil temperature measurements by different methods ➢ Estimation of water balance components in bare and cropped fields.

SSAC-502: Soil Fertility and Fertilizers use 4(3+1)

Objective

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

Theory:

Unit I: Soil fertility and soil productivity; nutrient sources - fertilizers and manures; essential plant nutrients - functions and deficiency symptoms.

Unit II: Soil and fertilizer nitrogen - sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency.

Unit III: Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions.

Unit IV: Potassium - forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions.

Unit V: Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium- factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers.

Unit VI: Micronutrients - critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability.

MAA Pateswari University, Balarampur,

Unit VII: Common soil test methods for fertilizer recommendations; quantity intensity relationships; soil test crop response correlations and response functions.

Unit VIII: Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management.

Unit IX: Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Practical

- ➢ Principles of colorimetry
- ➢ Flame-photometry and atomic absorption spectroscopy
- ➢ Chemical analysis of soil for total and available nutrients
- ➢ Analysis of plants for essential elements

MAA Pateswari University, Balarampur,

SSAC-503: Soil Chemistry 3(2+1)

Objective: To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils in relation to using soils as a medium for plant growth.

Theory:

Unit I: Chemical (elemental) composition of the earth's crust and soils.

Unit II: Elements of equilibrium thermodynamics, chemical equilibrium, electrochemistry and chemical kinetics. **Unit III:** Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, clay-organic interactions.

Unit IV: Ion exchange processes in soil; cation exchange- theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange – inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition.

Unit V: Potassium, phosphate and ammonium fixation in soils covering specific and nonspecific sorption; precipitation-dissolution equilibria; step and constant-rate K; management aspects.

Unit VI: Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity.

Unit VII: Chemistry of salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments.

Unit VIII: Chemistry and electrochemistry of submerged soils.

Practical ➢ Determination of CEC and AEC of soils ➢ Analysis of equilibrium soil solution for pH, EC, E h by the use of E h-pH meter and conductivity meter ➢ Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method ➢ Potentiometric and conduct metric titration of soil humic and fulvic acids ➢ (E 4/E 6) ratio of soil humic and fulvic acids by visible spectrophotometric studies and the (E 4/E 6) values at two pH values ➢ Adsorption-desorption of phosphate/sulphate by soil using simple adsorption isotherm ➢ Construction of adsorption envelope of soils by using phosphate/fluoride/sulphate and ascertaining the mechanism of the ligand exchange process involved ➢ Determination of titratable acidity of an acid soil by BaCl 2-TEA method ➢ Determination of lime requirement of an acid soil by buffer method ➢ Determination of gypsum requirement of an alkali soil.

SSAC-506: Soil Biology & Biochemistry 3(2+1)

Objective: To teach students the basics of soil biology and biochemistry, including biogeochemical cycles, plant growth promoting rhizobacteria, microbial interactions in soil and other soil activities.

Theory:

Unit I: Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; un cultivable soil biota.

Unit II: Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora.

Unit III: Microbial transformations of nitrogen, phosphorus, Sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation.

Unit IV: Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil.

Unit V: Preparation and preservation of farmyard manure, animal manures, rural and urban composts and Vermicompost.

Unit VI: Bio- fertilizers - definition, classification, specifications, method of production and role in crop production.

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Practical

➢ Determination of soil microbial population

➢ Soil microbial biomass

➢ Elemental composition, fractionation of organic matter and functional groups

➢ Decomposition of organic matter in soil

➢ Soil enzymes

➢ Measurement of important soil microbial processes such as ammonification, nitrification, N 2 fixation, S oxidation, P solubilization and mineralization of other micro nutrients

➢ Study of rhizosphere effect.

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Semester III

SSAC-505: Soil Erosion and conservation 3(2+1)

Objective: To enable students to understand various types of soil erosion and measures to be taken for controlling soil erosion to conserve soil and water.

Theory:

Unit I: History, distribution, identification and description of soil erosion problems in India.

Unit II: Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; raindrops and soil erosion; rainfall erosivity - estimation as EI30 index and kinetic energy; factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in relation to soil properties and precipitation.

Unit III: Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country.

Unit IV: Principles of erosion control; erosion control measures - agronomical and engineering; erosion control structures - their design and layout.

Unit V: Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.

Unit VI: Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds; use of remote sensing in assessment and planning of watersheds.

Practical

Determination of different soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index

- ➢ Computation of kinetic energy of falling rain drops
- ➢ Computation of rainfall erosivity index (EI 30) using rain gauge data
- ➢ Visits to a watershed

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SSAC-510: Remote Sensing & GIS Techniques for Soil, Water and Crop Studies 3(2+1)

Objective: To impart knowledge about the basic concepts of remote sensing, aerial photographs and imageries, and their interpretation; application of remote sensing in general and with special reference to soil, plants and yield forecasting; to impart knowledge about geostatistical techniques with special reference to krigging, and GIS and applications in agriculture.

Theory:

UNIT I: Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter.

UNIT II: Sensor systems - camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretation.

UNIT III: Application of remote sensing techniques - land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management.

UNIT IV: Significance and sources of the spatial and temporal variability in soils; variability in relation to size of sampling; classical and geo-statistical techniques of evolution of soil variability.

UNIT V: Introduction to GIS and its application for spatial and non-spatial soil and land attributes.

Practical

➢ Familiarization with different remote sensing equipment and data products

➢ Interpretation of aerial photographs and satellite data for mapping of land resources

➢ Analysis of variability of different soil properties with classical and geostatistical techniques

➢ Creation of data files in a database programed ➢ Use of GIS for soil spatial simulation and analysis

➢ To enable the students to conduct soil survey and interpret soil survey reports in terms of land use planning.

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SSAC-513: Management of Problematic Soils & Waters 3(2+1)

Objective: To educate students about basic concepts of problem soils and brackish water, and their management. Attention will be on management of problem soils and safe use of brackish water in relation to crop production.

Theory:

UNIT I: Area and distribution of problem soils - acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible.

UNIT II: Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties.

UNIT III: Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils.

UNIT IV: Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.

UNIT V: Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent; relationship in water use and quality.

UNIT VI: Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters.

Practical

➢ Characterization of acid, acid sulfate, salt-affected and calcareous soils

➢ Determination of cations (Na, K, Ca and Mg) in ground + + ++ ++ water and soil samples

➢ Determination of anions (Cl, SO, CO4 soil samples- -- --3 and HCO 3) in ground waters and

➢ Lime and gypsum requirements of acid and sodic soils

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CA-502: Computer Application in Agriculture 2 (1+1)

Theory:

Introduction to computer, operating system, definition and types, application of MS-Office for document creation & editing, data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, database concepts and types, us of DBMS in Agriculture, World Wide Web (WWW), Memory, Hasic Army Computer System. E-Agriculture concepts and applications, Use of ICT in Agriculture 11 Application for computation of water and nutrient requirement of crops computer-controlled devices (automated system) for agri-input management, smart phone apps in Agriculture. Decision support systems, concepts components and applications in agriculture.

Practical: Study of computer components, accessories, practice of important DOS Commands Introduction of different operating system such as window, files & folders, file management. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific document. MS-Excel - Creating a spreadsheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access-Creating database.

PGS- 501: Library and Information Services (Non Gradial Satisfactory & unsatisfactory) 1(0+1)

Practical:

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 abstract, 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 Internal including search engines and its resources, e-resources access methods.

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Semester IV

SSAC- 591: Master Seminar 1 (0+1) Presentation on relevant topic of concerned discipline

SSAC- 599: Master Research (Thesis) 20 (0+20) Perform research work and thesis writing on topic or title related to discipline of Horticulture.

SSAC-514: Advanced Organic Chemistry & Plant Biochemistry 4(3+1)

Theory:

Unit I: Characteristics of chemical bonds and covalency, classification of organic compounds. Nomenclature and their general properties.

Unit II: Chemistry of functional groups, chemistry of aromatic compounds (Benzene & Phenol). Heterocyclic compounds (Purines & Pyrimidines) organic reaction substance.

Unit III: Elimination & addition. General Chemistry of carbohydrates and photosynthesis of carbohydrates.

Unit IV: General Chemistry of lipids, amino acids, nucleic acids, plant pigments, alkaloids, plant hormones their chemistry & uses.

Unit V: Vitamins, classification and occurrence, chemistry and deficiency symptoms. General Chemistry of proteins & their biosynthesis, their classification, mechanism of their activity.

Practical: Related with course.

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SSAC-515: Advanced Bio-pesticides & Bio-Fertilizers 4(3+1)

Theory:

Unit I: History and concept of biopesticides. Importance, scope and potential of biopesticides, Definition concepts and classification of bio-pesticides viz. pathogen technology of bio-pesticides and biorationals. Botanical and their uses.

Unit II: Mass production technology of bio-pesticides. Virulence. Pathogenicity and symptoms of entomopathogenic pathogens and nematodes.

Unit III: Methods of application of biopesticides, methods of quality control and techniques of biopesticides. Impediments and limitation in production and use of biopesticides.

Unit IV: Biofertilizers- Introduction, status and scope, structure and characteristics features of bacterial biofertilizers. Azospirllum, azotobacter, bacillus, Pseudomonas, Rhizobium and Frankia. Cynobacterial biofertilizer-Anahaena, Nostac, Hapalosiphon and funnal biofertilizers-AM mycorrhiza and ectomycorrhiza. Nitrogen fixation –free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.

Unit V: Production technology: Strain selection, sterilization growth and fermentation, mass production of carrier based and liquid biofertlizers. FCO specifications and quality control of biofertilizres. Application technology for seeds, seedings, Tudors, sets etc. Biofertilizres-storage. Self-life. Quality control and marking factors influencing the efficacy of biofertilizres.

Practical:

Isolation and purification of important biopesticides. Trichoderma Pseudomonas, Bacillus, Metarhizium etc. and its production, Identification of important botanicals. Visit to biopesticides laboratory in nearby area. Field visit to explore naturally infected cadavers, Identification of entomopathogenic entities in filed condition. Quality control of biopesticides, Isolation and Purification of Azospirillum, Azotobactor, Rhizobium and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi wet sieving method and sucrose gradient method, Mass production of AM inoculants.

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SSAC-516 Soil Physical Environment and Plant Growth 4(3+1)

Theory:

UNIT I: Introduction: Effect of soil physical properties on plant growth - soil water, soil air, soil temperature, mechanical impedance and tillage practices.

UNIT II: Soil water: Soil moisture – plant water relations, available water, newer concepts of water availability, least limiting water range, soil-plant-atmosphere system as a physical continuum, plant uptake of soil moisture, evaporation, transpiration and evapotranspiration, dynamics of water in the soil plant-atmosphere continuum.

UNIT III: Root growth – germination and seedling emergence, hydraulic properties of roots, characterization of root growth parameters, water balance of the root zone, soil physical properties and root growth, flow of water to roots.

UNIT IV: Soil temperature – effect of soil temperature on plant growth, soil temperature management, thermal regimes, mulching, Radiation – heat budget and energy balance in the field, radiation use efficiency, radiation exchange in the field, exchange of heat and vapour to the atmosphere.

UNIT V: Aeration – critical oxygen concentration and factors affecting.

UNIT VI: Field water balance: Field water balance, irrigation and water use efficiency, consumptive use, plant uptake of soil moisture.

UNIT VII: Nutrients: Nutrient uptake and use by plants, managing soil physical condition for improved nutrient use efficiency, integrated nutrient management in relation to soil physical condition.

UNIT VIII: Resource conservation technologies: Bed planting and zero-tillage - types, suitability and effect on soil physical properties, other resource conservation technologies and the impact (short and long term) on soil health.

UNIT IX: Modelling: Interactions of soil, management and climatic factors on plant growth, and development of sustainability indices.

Practical:

Measurement of penetration resistance and LLWR; plant water potential; field saturated hydraulic conductivity; transpiration using porometer; root length density, root diameter, root weight using root scanner; germination percentage as affected by temperature; estimation of evapo-transpiration losses under different management options; measurement/estimation of consumptive water use, production functions, field water balance components, and water uptake by plants.

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SSAC-517 Soil Testing, Water Quality and fertilizer Recommendations 4(3+1)

Theory:

UNIT I: Soil testing – its scope and significance in sustainable agriculture; historical background and development of soil testing in India and future challenges; SWOT analysis of soil testing service; soil, plant and water sampling and processing techniques.

UNIT II: Soil test methods – principles and development; soil testing for primary, secondary and micronutrients; diagnosis and amelioration of problem soils; interpretation of soil test data; soil test summaries and soil fertility maps.

UNIT III: Sources of soluble salts and other impurities in water; quality of different water resources in India; interaction of ionic constituents in water with soil; leaching and salt movement through soil; water quality evaluation; factors affecting use of poor-quality irrigation water for crop production; management practices for using saline-sodic waters; sewage and industrial effluents for irrigation.

UNIT IV: Different approaches of fertilizer recommendation; critical nutrient concept; targeted yield and multiple regression techniques in soil test crop response studies; formulation of fertilizer dose for different types of crops and cropping systems including cereals, vegetables, ornamental and horticultural crops on normal and problem soils; fertilizer recommendations for rain-fed conditions, integrated plant nutrient supply systems.

UNIT V: Emerging concepts of fertilizer application; synchronizing nutrient supply with plant demand; site-specific nutrient management.

Practical:

Collection of soil and plant samples from agricultural and horticultural crops; sample processing; handling of laboratory instruments; determination of pH, EC and organic carbon; available nutrients (N, P, K, S, B, Zn, Cu, Fe and Mn); estimation of nonexchangeable K; lime requirement of acid soils and gypsum requirement of sodic soils; assessment of irrigation water quality; use of leaf colour chart in real-time N management; calculation of fertilizer doses.

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SSAC-518: Modeling Soil Plant System 4(3+1)

Theory:

UNIT I: Introduction, terms and definitions; classification of models; steps of modelling; Taylor series; numerical methods of differentiation and integration; convergence and stability of models.

UNIT II: High level computer language - FORTRAN its commands and usage; testing and evaluation of model.

UNIT III: Description of spatially homogeneous models; K transformation model; model on carbon, nitrogen and phosphorus dynamics in soil.

UNIT IV: Spatially heterogeneous models; equation of continuity; simulation of water flow through soil; explicit and explicit-implicit method; simulation of solute movement through soil by explicit method and with variable moisture flux by explicit-implicit method.

UNIT V: Nutrient uptake models; water uptake models; sensitivity analysis, parameter ranking and model simplification.

Practical:

Testing and usage of FORTRAN commands; writing, compiling, linking and execution of FORTRAN modules on K transformation and equilibrium in soils, C, N and P transformation in soils, water and salt movement in soils, nutrient uptake by plants.

Dr. Rekha Sharma (Convener) **Dr. Shiv Mahendra Singh** **Dr. Deepak Kumar Singh** **Prof. Anil Kumar Dwivedi**

Prof. N.K Singh (Ret. Principal **Dr. Ashutosh Kumar Verma**