



2. B.Sc. (Ag) FIRST YEAR SECOND SEMESTER

2.1 Introductory Nematology [PPT 102]

2 (1+1)

Theory:

Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes up to generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management. Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques), physical methods (soil solarisation, hot water treatment) Biological methods, Chemical methods (fumigants, non fumigants). Resistant varieties. IDM.

Practical:

1. Methods of survey - sampling methods, collection of soil and plant samples;
2. Extraction of nematodes from soil and plant tissues following combined Cobb's decanting - sieving and Baermann funnel technique, counting and estimation of plant parasitic nematodes;
3. Preparation of temporary and permanent mounts;
4. Method of preparation of perineal patterns for identification of species of Meloidogyne;
5. Study and identification of most important plant parasitic nematodes with special reference to their characteristics and symptomatology - Meloidogyne, Pratylenchus; Heterodera, Ditylenchus, Globodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus, and Helicotylenchus.
6. Experimental techniques used in pathogenicity studies with root knot nematode.

**References:**

1. Dropkin, V.H. (1980). Introduction to plant nematology. John Wiley and Sons, INC. New York.
2. Singh, R.S and Sitaramaiah, K. (1994). Plant pathogens. The plant parasitic nematodes. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi.
3. Parvata Reddy, P. (1983). Plant nematology. Agricole Pub. Co., New Delhi.
4. Southey, J. F. Laboratory methods for work with plant and soil nematodes Tech. Bull. Min. Agric. Fish. Food. Her Majesty's Stationary Office, London.

2.2 Statistics [AST 101]**2(1+1)****Theory:**

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error; Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and the regression coefficients, fitting of regression equations. Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

**Practical:**

1. Construction of Frequency Distribution Tables and Frequency Curves;
2. Computation of Arithmetic Mean for Un-Grouped and Grouped data;
3. Computation of Median for Un-Grouped and Grouped data;
4. Computation of Mode for Un-Grouped and Grouped data;
5. Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data;
6. SND test for Means, Single Sample;
7. SND test for Means ,Two Samples;
8. Student's t-test for Single Sample;
9. Student's t-test for Two Samples;
10. Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity;
11. Computation of Correlation Coefficient 'r' and its testing;
12. Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD);
13. Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

References:

1. Fundamentals of Mathematical Statistics- S.C. Gupta & V.K. Kapoor, Sultan Chand & sons Educational Publishers, New Delhi.
2. Statistical Methods and Experimental Design- Pro. R. Singh & Dr. A.K. Sharma, Aman Publishing House, Meerut.
3. A Text Books of Agricultural Statistics- R. Rangaswamy, New Age International (p) Limited, Publishers, New Delhi.
4. Practical Mannuals on Design of Experiments- Dr. V.B. Singh, RVSKVV, Publishers, Gwalior.



2.3 Water Management Including Micro-irrigation [AGR 103]

3(2+1)

Theory:

Irrigation: definition and objectives, water resources and irrigation development in India; Soil plant water relationships; Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage.

Practical:

1. Determination of bulk density by field method;
2. Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter;
3. Determination of field capacity by field method;
4. Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs;
5. Calculation of irrigation water requirement (Problems);
6. Determination of infiltration rate;
7. Demonstration of furrow method of irrigation;
8. Demonstration of check basin and basin method of irrigation;
9. Visit to farmers field and cost estimation of drip irrigation system;
10. Demonstration of filter cleaning, fertigation, injection and flushing of laterals;
11. Erection and operation of sprinkler irrigation system;
12. Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability;
13. Determination of EC, pH, carbonates, bicarbonates, Ca^{++} and Mg^{++} in irrigation water (quality parameters)

**References:**

1. Micro-irrigation and water management- Pawar et al.
2. Irrigation-theory and practices- A.M. Mienoel
3. Water management- principles / practices.- R.A. Singh
4. Irrigation and water management - Pawar et al.
5. Text book of irrigation and management- Mukund Joshi

2.4 Principles of Seed Technology [GPB 102]**3(2+1)****Theory:**

Importance of Seed Production, Seed policy, Seed demand forecasting and planning for certified, foundation and breeder seed production, Deterioration of crop varieties, Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed, Different classes of seed, Production of nucleus & breeder's seed, Maintenance and multiplication of pre-release and newly released varieties in self and cross-pollinated crops; Seed Production: Foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); rice (varieties & hybrids); sorghum and bajra (varieties, hybrids, synthetics and composites); cotton, sunflower (varieties and hybrids); castor (varieties and hybrids); tomato and brinjal (varieties and hybrids); chillies and bhindi (varieties and hybrids); onion, bottle gourd and ridge gourd (varieties and hybrids); Seed certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through Grow-Out Test and Electrophoresis; Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop



dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Planning and layout of seed processing plant; Establishment of seed processing plant. Seed processing: air screen machine and its working principle, different upgrading equipments and their use, establishing a seed testing laboratory. Seed testing procedures for quality assessment, Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist-O-matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control, Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy; Factors affecting seed marketing.

Practical:

1. Seed sampling principles and procedures;
2. Physical Purity analysis of seed of Field and Horticultural crops;
3. Germination analysis of seed of Field and Horticultural crops;
4. Moisture tests of seed of Field and Horticultural crops;
5. Viability test of seed of Field and Horticultural crops;
6. Seed health test of Field and Horticultural crops;
7. Vigour tests of Field and Horticultural crops;
8. Seed dormancy and breaking methods;
9. Grow out tests and electrophoresis for varietal identification;

References:

1. Khare D. and M.S. Bhale (2000). Seed Technology, Scientific Publishers (India)
2. Copeland L.O. Principles of Seed Technology, Burgess Publi.
3. Thomson I.R. An Introduction to Seed Technology Leonard Hill
4. Agarwal R.L. Seed Technology Oxford and IBH



5. Tomar HPS Seed Technology Aman Publishers
6. S.V. Singh Minimum Seed certification standards
7. Seed Science and Technology (1985). ISTA
8. Seed Technology by Mukesh kumar
9. Seed act (1966).

2.5 Principles of Agricultural Economics [AEC 101] 2(2+0)

Theory:

Economics: Meaning, Definition, Subject matter, Divisions of Economics, Importance of Economics; Agricultural Economics: Meaning, Definition; Basic Concepts: Goods, Service, Utility, Value, Price, Wealth, Welfare. Wants: Meaning, Characteristics, Classifications of Wants, Importance. Theory of consumption: Law of Diminishing Marginal utility, Meaning, Definition, Assumption, Limitations, Importance. Consumer's surplus: Meaning, Definition, Importance. Demand: Meaning, Definition, Kinds of Demand, Demand schedule, Demand Curve, Law of Demand, Extension and Contraction Vs Increase and Decrease in Demand. Elasticity of Demand: Types of Elasticity of Demand, Degrees of price elasticity of Demand, Methods of Measuring Elasticity, Factors influencing elasticity of Demand, Importance of Elasticity of Demand. Welfare Economics: Meaning, Pareto's optimality. National Income: Concepts, Measurement. Public Finance: Meaning, Principles. Public Resource: Meaning, Services Tax, Meaning, Classification of Taxes: Cannons of Taxation, Public expenditure: Meaning, Principles. Inflation: Meaning, Definition, Kinds of inflation

References:

1. K.K.Dewett and J.D. Varma (1986). Elementary Economic Theory, S. Chand & Company, New Delhi.
2. P.A. Samuelson & W.D. Nordhaus (1987). Economics, McGraw-Hill, Singapore.
3. S.K. Misra and V.K. Puri (1996). Indian Economy, Himalaya Publishing House, New Delhi.



4. G.B. Jathar and S.G. Beri (1996). Elementary Principles of Economics, Oxford University Press (10th Edition), Delhi.
5. Berkeley Hill (1980). An Introduction to Economics for Students of Agriculture, Pergaman Press, Oxford.

2.6 Dimensions of Agricultural Extension [EXT 101]

2(1+1)

Theory:

Education - Meaning, Definition, Types - Formal, Informal and Non-formal education and their Characteristics. Extension Education and Agricultural Extension - Meaning, Definition, oncepts, Objectives and Principles. Rural development - Meaning, Definition, Concepts, Objectives, Importance and Problems in rural development. Developmental programmes of pre-independence era - Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive proprogramme. Development programmes of Post independence era, Firka Development, Etawah - Pilot project and Nilokheri Experiment. Community Development Programme - Meaning, Definition, Concepts, Philosophy, Principles, Objectives, Differences between Community Development and Extension Education, National Extension service, Panchayat Raj system - Meaning of Democratic - Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system, Powers, Functions and Organizational setup. Agricultural Development Programmes with reference to year of start, objectives & sailent features - Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC. Social Justice and Poverty alleviation programmes - Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarojgar Yojana (SGSY), Prime Minsiter Employment Yojana (PMEY).New trends in extension, privatization. Women Development programmes - Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samriddi Yojana (MSY). Reorganized extension system (T&VSystem)-Salient features, Fort night Meetings,Monthly workshops, Linkages, Merits and Demerits, Emergence of Broad Based Extension (BBE)

**Practical:**

1. Visits to a village and kisan mandal to study the ongoing development programmes.
2. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & Zilla Praja Parishad (ZPP).
3. Visit and study the District Rural Development Agency (DRDA).
4. Participation in monthly workshops of Training and Visit (T & V) System.
5. Visit to Watershed Development Project area. Visit to a village to study the Self Help Groups (SHGs) of DWCRA. Visit to a voluntary organization to study the developmental activities.
6. Organizing PRA techniques in a village to identify the agricultural problems.

References:

1. Adivi Reddy A. (2001). Extension Education, Sree Laxmi Press, Bapatla, A.P.
2. Ray GL. (1999). Extension Communication and Management, Noya prakash, Calcutta, West Bengal.
3. Dahama OP and Bhatnagar, OP (1998). Education and Communication for Development, Oxford and IBH Co, New Delhi.
4. Singh A.K. (2000). Agricultural Extension.- Impact and Assessment, Agri-bios (India), New Delhi.
5. Benor, Harrison and Baxter (1984). Agricultural Extension - The Training and visit system, A World Bank Publication, Washington DC, USA.
6. Badodiya, S.K.; Daipuria, O.P. and Patel, M.M. (2013). A Handbook of Dimension of Extension Education Agrotech Publishing Academy, Udaipur.



2.7 Agricultural Microbiology [BCH 101]

3(2+1)

Theory:

History of Microbiology: Spontaneous generation theory, Role of microbes in fermentation, Germ theory of disease, Protection against infections, Applied areas of Microbiology Metabolism in bacteria: ATP generation, chemoautotrophy, photo autotrophy, respiration, fermentation. Bacteriophages: structure and properties of Bacterial viruses – Lytic and Lysogenic cycles: viroids, prions. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified Organisms. Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, Biological nitrogen fixation. Microflora of Rhizosphere and Phyllosphere microflora, microbes in composting. Microbiology of Water. Microbiology of food: microbial spoilage and principles of food preservation. Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides, Microbial agents for control of Plant diseases, Biodegradation, Biogas production, Biodegradable plastics, Plant – Microbe interactions.

Practical:

1. General instructions, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory;
2. Practice of Aseptic methods: I - Evaluation of aseptic technique with Nutrient broth tubes. II- Evaluation of aseptic technique with a Nutrient agar plate.
3. Methods of Sterilization and Preparation of media I- Preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stablbing;
4. Sterilization of glassware by Dry heating;
5. Sterilization of nutrient broth by Filtration.
6. Plating methods for Isolation and Purification of bacteria I - Isolation of bacteria by Streak plate method.



7. Isolation of aerobic spore forming bacteria by Enrichment using Streak plate method.
8. Checking of purity of a bacterial culture by Streak plating method.
9. Identification of bacteria by staining methods and Biochemical tests: I- Morphological examination of bacteria by Simple and Differential staining.
10. Different biochemical tests for identification of bacterial culture;
11. Enumeration of bacteria: I - Enumeration of bacteria by Stain slide method.
12. Enumeration of bacteria by most probable number method.
13. Enumeration of bacteria by Pour plate method and Spread plate method.

References:

1. Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. (1993). Microbiology. Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2. Stanier, R.Y., Ingraham, Wheelis, M.G. and Paintor, P.R. (1986). The Microbiology World. Prentice Hall, New Jersey.
3. Tauro, P., Kapoor, K.K. and Yadav, K.S. (1989). An Introduction to Microbiology. Wiley Publications, New Delhi.
4. Alexander, M. (1985). Introduction to Soil Microbiology. John Wiley & Sons, New York.
5. Subba Rao, N.S. (1999). Biofertilizers in Agricultural and Agroforestry. Oxford & IBH, New Delhi.
6. Subba Rao, N.S. (1995). Soil Micro-organisms and Plant Growth. Oxford & IBH, New Delhi.

2.8 Introduction to Computer Applications [AST 102]**2(1+1)****Theory:**

Introduction to Computers, Anatomy of Computers, Input and Output Devices. Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of Processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines. Operating System – DOS and



WINDOWS. Disk Operating System (DOS): Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. WINDOWS: GUI, Desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date, starting and shutting down of WINDOWS. Anatomy of a WINDOW, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars. Applications - MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and Saving a document in MSWORD; MSEXCEL: Electronic Spreadsheets, concept, packages. Creating, Editing and Saving a spreadsheet with MSEXCEL. Use of in-built Statistical and other functions and writing expressions. Use of Data Analysis Tools, Correlation and Regression, t-test for two-samples and ANOVA with One-way Classification. Creating Graphs. MS Power Point: Features of Power Point Package. MSACCESS: Concept of Database, Units of database, creating database; Principles of Programming: Flow Charts and Algorithms, illustration through examples. Internet: World Wide Web (WWW), Concepts, Web Browsing and Electronic Mail.

Practical:

1. Study of Computer Components;
2. Booting of Computer and its Shut Down;
3. Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH; Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars;
4. WINDOWS Explorer, Creating Folders, COPY and PASTE functions;
5. MSWORD: Creating a Document, Saving and Editing; MSWORD, Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text;
6. MSWORD, Creating a Table, Merging of Cells, Column and Row width;
7. MSEXCEL: Creating a Spreadsheet, Alignment of rows, columns and cells using Format tool bar;



8. MSEXCEL: Entering Expressions through the formula tool bar and use of inbuilt functions, SUM, AVERAGE, STDEV;
9. MSEXCEL: Data Analysis using inbuilt Tool Packs, Correlation & Regression;
10. MSEXCEL: Creating Graphs and Saving with & without data;
11. MSACCESS: Creating Database, Structuring with different types of fields;
12. MS Power Point: Preparation of slides on Power Point;
13. Transforming the data of WORD, EXCEL and ACCESS to other formats;
14. Internet Browsing: Browsing a Web Page and Creating of E-Mail ID

References:

1. A First Course in Computers- Sanjay Saxena, Vikas Publishing House Pvt. Ltd. New Delhi.
2. Basic of Computer and Information Technology- Dr. M.K. Sahu & Pravin Jain, Devi Ahilya Prakashan, Indore.
3. Computer fundamentals (Fourth Edition) - Pradeep K. Sinha & Priti Sinha, BPB Publication, New Delhi.
4. Pragma Gyanodaya Computer Course- Pragma Publisher distributors, Gwalior.

2.9 Soil Chemistry, Soil Fertility and Nutrient Management [SAC 102]**3 (2+1)****Theory:**

Soil as a source of plant nutrients. Essential and beneficial elements, criteria of essentiality, forms of nutrients in soil , mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities. Problem soils - acid, salt affected and calcareous soils, characteristics, nutrient availabilities. Reclamation - mechanical, chemical and biological methods. Fertilizer and insecticides and their effect on soil water and air. Irrigations water - Quality of irrigation water and its



appraisal. Indian standards for water quality. Use of saline water for agriculture. Soil fertility – Different approaches for soil fertility evaluation. Methods, Soil testing – Chemical methods. critical levels of different nutrients in soil. Plant analysis – DRIS methods, critical levels in plants. Rapid tissue tests. Indicator plants. Biological method of soil fertility evaluation. Soil test based fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

Practical:

1. Principles of analytical Instruments and their calibration and applications, Colorimetry and flame photometry.
2. Estimation of available N, P, K, S, and Zn in oils, pH, EC, soluble cations and anions in soil water extracts.
3. Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

References:

1. Soil Fertility and Fertilizers - Tisdale, Nelson, Beaton and Havlin
2. Soil Fertility and Plant Nutrition - Kanwar and Chopra
3. Handbook of Fertilizer and Manures - ICAR Publication
4. Manures and Fertilizers - Yawalkar
5. Fertilizers organic manures and Recyclable waste - H.L.S. Tondon
6. Saline and alkali Soils of India – Agarwal, Yadav & Gupta
7. Soil Solirity and water quality - Ranbir Chhabra