## FACULTY OF AGRICULTURE
### COURSWISE SCHEME 2015-16

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COMPULSORY/OPTIONAL</th>
<th>SUBJECT CODE</th>
<th>SUBJECT NAME</th>
<th>THEORY</th>
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<tbody>
<tr>
<td>1</td>
<td>COMPULSORY</td>
<td>201</td>
<td>INTRODUCTORY NEMATOLOGY</td>
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<td>COMPULSORY</td>
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<td>3</td>
<td>COMPULSORY</td>
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<td>WATER MANAGEMENT INCLUDING MICRO IRRIGATION</td>
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<td>COMPULSORY</td>
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<td>PRINCIPLES OF SEED TECHNOLOGY</td>
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<td>DIMENSION OF AGRICULTURAL EXTENSION</td>
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<td>COMPULSORY</td>
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<td>AGRICULTURAL MICROBIOLOGY</td>
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<td>COMPULSORY</td>
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<td>INTRODUCTION TO COMPUTER APPLICATION</td>
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<td>9</td>
<td>COMPULSORY</td>
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<td>SOIL CHEMISTRY, SOIL FERTILITY &amp; NUTRIENT</td>
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2.2.1. Introductory Nematology (INT)       Credit: 2(1+1)

Theory
1. Introduction, Nematodes, habitat and diversity
2. History of Phytonematology, early and modern history, Land Mark historical events.
3. Economic importance of plant parasitic nematodes and their general characteristics.
4. Nematode general morphology and biology, shape, size, body organization and Symmetry. Outer body wall (Cuticle, Hypodermis, Musculature), Alimentary canal (Inner body tube) male and female reproductive systems, Nervous and excretory systems.
6. Classification of nematodes up to family level with emphasis on groups containing economically important plant parasitic nematodes up to generic level with the help of keys and description.
7. Above ground and below ground symptoms caused by nematodes.
8. Interaction between plant parasitic nematodes and disease causing fungi bacteria and viruses.
9. Different methods of nematodes management
   A. Cultural methods - crop rotations, fallowing, flooding, propagation through healthy planting material, removal of infected plants, organic amendments, trap crops, time of sowing.
   C. Biological methods and chemical control.
   D. Regulatory methods and integrated control.
   E. Host resistance.

Practical
1. Introduction and equipments used in phytonematology.
2. Sampling methods, collection of soil and plant samples.
3. Extraction of nematodes by cobb's sieving and decanting methods and Baermann's funnel technique.
5. Identification of : Meloidogyne, Pratylenchus, Heterodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus, Helicotylenchus
6. Technique of pathogenicity of Meloidagenye.
7. Methods of preparation of perinneal pattern.

Suggested readings
1. Introductory Nematology       – R.K. Walia and H.K. Bajaj
2. Plant Nematology               – Pathak and B.S. Yadav
5. Plant Disease                  – R.S. Singh
2.2.2. Statistics (AST)  

**Theory**

1. Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves.
2. Measures of Central Tendency: Characteristics of ideal Average, Arithmetic mean, Median, Mode, Merits and Demerits of Arithmetic Mean.
5. Introduction to Sampling: Random Sampling; the concept of Standard Error.
6. 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; Students t-test for Single Sample, Two Samples and Paired t test : Chi-Square Test in 2X2 Contingency Table, Yate’s Correction for continuity
7. Correlation : Types of Correlation and identification through Scatter Diagram, computation of Correlation Coefficient ‘r’ and its testing
8. Linear Regression : Of Y on X and X on Y, Inter-relation between ‘r’ and the regression coefficients, fitting of regression equations
9. 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 Variance Standard Deviation and coefficient of variation for un-grouped and grouped data
6. SNI test for means, single sample; SND test for mean, two sample
7. Student’s t-test for single sample; student’s t-test for two samples; Paired t test and F test
8. Chi-Square Test in 2x2 Contingency Table, Yate’s Correction for continuity
9. Computation of Correlation Coefficient ‘r’ and its testing
10. Fitting of regression equations-Y on X and X on Y
11. Analysis of CRD
12. Analysis of RBD
13. Analysis of LSD

**Suggested readings**

1. Fundamentals of Statistics - D.N. Elhance
3. Basic Statistics - B.L. Agrawal
2.2.3. Water Management including Micro irrigation (WMI)  
Credit: 3 (2+1)

Theory
1. Irrigation: Definition and objectives
2. Water resources and irrigation development in India and M.P.
3. Soil-Plant-Water relationships
4. Methods of soil moisture estimation, evapo-transpiration and crop water requirement
5. Effective rainfall, scheduling of irrigation
6. Methods of irrigation (Surface, sprinkler and drip irrigation)
7. Irrigation efficiency and water use efficiency
8. Conjunctive use of water
9. Irrigation water quality and its management
10. Water management of rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato
11. Agricultural drainage

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

Suggested readings
1. Micro-irrigation and water management – Pawar et al.
2. Irrigation-theory and practices – A.M. Michael
2.2.4. Principles of Seed Technology (PST)  
Credit: 3 (2+1)

Theory
1. Introduction of seed production: importance of seed production, seed policy, seed demand forecasting and planning for certified, foundation and breeder seed production
2. Deterioration of crop varieties, factors affecting deterioration and their control, maintenance of genetic purity during seed production
3. Seed quality, definition, characters of good quality seed
4. Different classes of seed, production of nucleus and breeder seed maintenance and multiplication of prerelease and newly released varieties in self and cross pollinated crops
5. Seed production: foundation and certified seed production in Maize (varieties hybrids, synthetics and composites), Rice (varieties and hybrids), Sorghum and bajra (varieties, hybrids, synthetics and composites), Cotton and sunflower (varieties and hybrids), Castor (varieties and hybrids), Tomato and brinjal (varieties and hybrids) Chillies and bhendi (varieties and hybrids), Onion, bottle gourd and ridge gourd (varieties and hybrids)
6. Seed certification: phases of certification, procedure for seed certification, field inspection and field counts etc.
7. Seed Act and Seed Act enforcement: Central Seed Committee, Central Seed Certification Board, State Seed Testing Laboratories, Duties and powers of seed inspectors, Offences and penalties
8. Seed control order: Seed Control Order 1983, Seed Act 2000, other issues related to seed quality regulation, intellectual property rights, patenting, WTO, plant breeders rights
9. Varietal identification: Grow-out test, electrophoresis
10. Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, hot air, air drying building requirements, types of air distribution system for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying.
11. Seed processing plant: Planning and layout, establishment
12. 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
13. Seed treatment: importance of seed treatment, types of seed treatment, equipment used for seed treatment (slurry and mist-O-matic treater)
14. Seed packing and seed storage: stages of seed storage, factors affecting seed longevity during storage, conditions required for good storage, general principle of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control
15. 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 Field and Horticultural crops
3. Germination analysis of Field and Horticultural crops
4. Moisture tests of Field and Horticultural crops
5. Viability test of Field and Horticultural crops
6. Seed health test of Field and Horticultural crops
7. Vigour tests Field and Horticultural crops
8. Seed dormancy and breaking methods
9. Grow, out tests and electrophoresis for varietal identification
10. Visit to seed production plots of Maize, Sunflower, Bajra, Rice, Sorghum, Cotton, Chillie and Vegetables (add or delete crops of the region)
11. Visit to Seed processing plants
12. Visit to Seed testing laboratories
13. Visit to Grow out testing farms
14. Visit to Hybrid Seed Production farms
15. Varietal identification in seed production plots
16. Planting ratios, isolation distance, roughing etc.

**Suggested readings**

1. Seed Technology – R.L. Agrawal
2. Seed Technology – D. Khare and M.S. Bhale
3. Seed Science and Technology – L.P. Copeland & M.V. MacDonald
4. Principles of Seed Technology – Chore, Shembekar, Ghandekar and Waghmare
5. Seed Science Technology – S. Sen

**2.2.5. Principles of Agricultural Economics**

**Theory**

Credit: 2 (2+0)

1. Meaning, Definition, Subject Matter
2. Division of Economics, Importance of Economics
3. Meaning, Definition of Agricultural Economics
5. Wants: Classification and Characteristics
6. Theory of consumption
7. Law of diminishing marginal utility – meaning, definition, importance
8. Consumer surplus – Meaning, definition, importance
9. Demand – meaning, definition, kinds of demand, demand schedule
10. Demand Curve, Law of demand
11. Extension and contraction v/s increase and decrease in demand
12. Elasticity of demand, type of elasticity of demand
13. Degrees of price elasticity of demand, methods of measuring elasticity
14. Factors influencing elasticity of demand, importance of elasticity of demand
15. Welfare Economics – Meaning, Pareto’s optimality
16. National income – concept, measurement
17. Public finance – Meaning, Principles
18. Public resource – Meaning
19. Service tax – Meaning
20. Classification of Taxes – Cannons of taxation
21. Public expenditure – Meaning, principles
22. Inflation – Meaning, definition, kinds of inflation

**Suggested readings**

1. Fundamentals of Agricultural Economics – K.N. Sandhu & Amarjeet Singh
2. Agricultural Economics – A.G. Desai
3. Agricultural Economics – S.Subha Reddy et al
4. Agricultural Economics – P. Raghuram
2.2.6. Dimensions of Agricultural Extension

Theory

1. Meaning and Definition of Education, Formal, Informal and Non-formal education and their characteristics
2. Meaning, definitions, concept, objectives of Extension Education/Agricultural Extension, Principles of Extension Education
3. Meaning, definition and concept of Rural Development, Objectives of Rural Development. Importance of rural development, Problems in rural development, Development programmes of pre independence era and post independence era
4. Shriniketan and Marthandam Project
5. Gurgaon Project and Gandhian Constructive Programme
6. Firka Development Programme, Etawah-Pilot Project and Nilokheri Experiment Project
7. Community Development Programme – Meaning, definition, concepts, philo-sophy, principles and objectives
8. Differences between community development and extension education
10. Panchyati Raj System – Meaning of democratic decentralization of power, Three tiers System of Panchyati Raj

Agriculture Development Programme with reference to year of start, objectives and salient features

12. Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP)
13. Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP)
14. National Agricultural Technology Project (NATP)
15. Agricultural Technology and Management Agency (ATMA)
16. Agricultural Technology Information Centre (ATIC)

Social Justice and Poverty Alleviation Programmes

17. Integrated Tribal Development Agency (ITDA)
18. Integrated Rural Development Programme (IRDP)
19. Swarna Jayanti Gram Swarojgar Yojana (SGSY)
20. Prime Minister Rojgar Yojana (PMGY)
21. New trends in extension, privatization

Women Development Programmes
22. Development of Women and Children in Rural Areas (DWCRA)
23. Rashtriya Mahila Kosh (RMK)
24. Integrated Child Development Scheme (ICDS)
25. Mahila Samridhi Yojana (MSY)
26. Reorganized Extension System (T&V system) – salient features
27. Fortnight meetings, Monthly workshops, linkages, merits and demerits
28. Emergence of Broad Based Extension (BBE)

Practical

1. Visit to Village and Kisan Mandal to study the ongoing development programmes
2. Visit to Panchayati Raj Institutions to study the functioning of Gram Panchayat (GP), Janpad Panchayat (JP) and Zila Panchayat
3. Visit and study the District Rural Development Agency (DRDA)
4. Participation in monthly workshop of Training and Visit System (T & V system)
5. Visit to Watershed Development Project Area
6. Visit to a village to study the Self Help Groups (SHGs) of DWCRA
7. Visit to a voluntary Organization to study the development activities
8. Organizing PRA techniques in a village to identify the agricultural problems.

Suggested readings

1. A textbook of Extension Education – Ranjeet Singh
2. Introduction to extension education – S. V. Supe
3. Extension Education – A.A Reddy
4. Dimension of Agricultural Extension – Singh, Roy & Burman
5. Rural Development – G.L. Jain

2.2.7. Agricultural Microbiology (AMB)  
Credit: 3(2+1)

Theory

I. History of Microbiology
   1. Spontaneous generation theory and germ theory
   2. Protection against infection
   3. Applied areas of microbiology and fermentation

II. Applied areas of microbial metabolism
   1. Microbial ATP generation through different metabolic pathways – glycolysis, Embden-Meyerhop pathway, pentose cycle, Entner-Doudoroff pathway, and phosphodeloase pathway
   2. Microbial fermentation – some major pathways of fermentation viz., ethanol and lactic acid fermentation
   3. Microbial respiration – aerobiosis and anaerobiosis

III. Bacteriophages
   1. Structure and properties of bacterial viruses (bacteriophages), existence of bacteriophages-lytic and lysogenic phages/cycles
   2. Some specific forms of viruses – viriods and prions

IV. Bacterial genetics
   a. Genetic expression
      1. Genetic control of metabolism
      2. Protein synthesis
   b. Genetic recombination (recombination in bacteria)
      1. Transformation, transduction and conjugation
   c. Genetic engineering
      1. Basic principles and techniques in genetic engineering
      2. Genetic transposable elements in bacteria – plasmids, episomes, IS and Tn elements
      3. Genetic manipulation and genetically modified organisms

V. Soil microbiology
   1. Microbial groups in soil-bacteria, actinomycetes, fungi, algae, and protozoa – their characteristic morphology,
significance and environmental influences
2. Microbial transformations of nutrients in soil – cycles of carbon, nitrogen, phosphorus and sulfur
3. Biological nitrogen fixation – symbiotic and non-symbiotic, microorganisms involved and their biochemistry

VI. Microbiology of water (drinking water)
1. Laboratory tests for detecting microbial contamination

VII. Microbiology of food
1. Microbes important in foods
2. Principles of food preservation – heat treatment, low temperature preservation, drying, preservation by additives
3. Microbial spoilage of foods – thermophilic and mesophilic organisms

VIII. Beneficial microorganisms in Agriculture
a. Biofertilizers
1. Biofertilizers – classification, physiological relationships, principles of isolation, purification and maintenance of strains
2. Production, application, precautions in handling and benefits from their uses

b. Biopesticides
1. Biopesticides – classification, basic modes of actions
2. Production (small and large scale), application, and precautions in handling

IX. Microbiology of waste disposal and recycling
1. Sewage disposal
2. Solid waste recycling (composting)
3. Biogas production
4. Biodegradation of decomposable plastics

Practical
1. General instructions: Familiarization with laboratory microbiological instruments materials, glassware etc.
2. Practice of aseptic methods: Evaluation of aseptic technique with nutrient agar plate.
3. Evaluation of aseptic technique with nutrient broth tubes.
4. Methods of sterilization and preparation of media:
   a. Preparation of nutrient broth, nutrient agar plate’s, nutrient agar and slant and nutrient agar stabling – II
   b. Sterilization of glassware by dry heating
   c. Sterilization of nutrient broth by filtration planting method for isolation and purification of bacteria
5. Isolation of bacteria by streak plate method
6. Isolation of aerobic spores forming bacteria by enrichment using streak plate method
7. Checking of purity of a bacterial culture by streak planting method
8. Identification of bacteria by staining method and biochemical test
9. Morphological examination of bacteria by simple and differential staining
10. Different biochemical tests for identification of bacterial culture; Enumeration of bacteria by stain slide method
11. Enumeration of bacteria by most probable number methods
12. Enumeration of bacteria stains slide method by pour plate method and spread plate method.

Suggested readings
1. Agricultural Microbiology – N. Mukherjee and T. Ghosh
2. Microbiology – S.S. Purohit
3. Agricultural Microbiology – Rangawwami & Bhagyarat
4. Soil Microbiology – N.S. Subba Rao
5. An Introduction to Microbiology – P.Tauro, K.K.Kapoor and K.S. Yadav
2.2.8. Introduction to Computer Applications (COM)  Credit: 2 (1+1)

Theory

1. Introduction to Computers, Input and output Devices, Units of Memory
2. Hardware, Software and Classification of computers. Types of Processors
3. Booting of Computers, warm and cold booting, computer viruses, worms and vaccines
4. Operating System – DOS and DOS commands
5. Operating system WINDOWS and its elements
6. MS-WORD, features of word processing
7. Creating, Editing document in word
8. MS-EXCEL-Electronic spreadsheet, concept, packages
9. Creating, editing and saving a spread sheet
10. Editing cell contents
11. Commands for worksheet
12. Use of in-built Statistical and other functions and writing expressions
13. Use of Data Analysis tools, correlation and Regression
14. Entering expressions, Creating graphs
15. t-test for two samples and ANOVA with one way classification
16. Introduction to MS Power Point, features of power point package
17. Creating new presentation, power point views
18. Introduction to MS Access, concept of data base, creating data base
19. Creating tables in data base
20. Principles of programming, flow charts
21. Algorithms, illustration through examples
22. Introduction to Internet
23. World wide web, information retrieval
24. Introduction to electronic mail
25. Advantages of E-mail

Practical

1. Study of computer components
2. Practice of DOS commands
3. Practicing windows operating system
4. Creating folders, copy and paste
5. Creating a document
6. Formatting documents
7. Creating a table, merging of cells
8. Creating spread sheet and formatting
9. Entering expressions through formula tool bar and use of in built functions, SUM, AVERAGE, STDEV etc.
10. Creating Graphs in MS Excel
11. Preparing power point slides
12. Creating Data database
13. Creating tables in data base
14. Transforming the data of WORD, EXCEL and ACCESS to other formats
15. Internet browsing
16. Creating E-mail ID

Suggested readings
1. Repidex Computer Courses - Neogy, A.Gupta, Amit, Gupta And Rohit Gupta
2. Programming in BASIC - E.Balaguruswami
4. Microsoft Office - B.P.B.Publication
5. Microsoft DOS - Peter Norton’s Techmedia

2.2.9. Soil Chemistry, Soil Fertility and Nutrient (SFM)       Credit: 3(2+1)

Theory

2. Forms of nutrients in soil, mechanisms of nutrient transport to plants
3. Functions of N and measures to overcome deficiencies and toxicities
4. Factors affecting nutrient availability of N to plants and Nitrogen use efficiency (NUE)
5. Functions of P and measures to overcome deficiencies and toxicities
6. Factors affecting nutrient availability of P to plants and Phosphorus use efficiency (PUE)
7. Functions of K and measures to overcome deficiencies and toxicities
8. Factors affecting nutrient availability of K to plants and Potash use efficiency (PUE)
9. Functions of S and measures to overcome deficiencies and toxicities
10. Factors affecting nutrient availability of S to plants and sulphur use efficiency (SUE)
11. Functions of Ca and Mg and measures to overcome deficiencies and toxicities
12. Factors affecting nutrient availability of other Ca and Mg to plants
13. Functions of Fe and measures to overcome deficiencies and toxicities
14. Factors affecting nutrient availability of Fe to plants and Iron use efficiency (IUE)
15. Functions of Zn and measures to overcome deficiencies and toxicities
16. Factors affecting nutrient availability of Zn to plants and Zinc use efficiency (ZUE)
17. Functions of micronutrients and measures to overcome deficiencies and toxicities
18. Factors affecting nutrient availability of other micronutrients to plants
19. Problem soils – acid, salt affected and calcareous soils, characteristics, nutrient availabilities
20. Reclamation – mechanical, chemical and biological methods
21. Fertilizer and insecticides and their effect on soil water and air
22. Irrigation water – Quality of irrigation water and its appraisal
23. Indian standards for water quality. Use of saline water for agriculture
24. Soil fertility – Different approaches for soil fertility evaluation
25. methods, soil testing – chemical methods. Critical levels of different nutrients in soil
26. Plant analysis – DRIS methods, critical levels in plants
27. Rapid tissue tests, Indicator plants
28. Biological method of soil fertility evaluation
29. Soil test based fertilizer recommendations to crops
30. 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 in soils
3. Estimation of available P in soils
4. Estimation of available K in soils
5. Estimation of available S in soils
6. Estimation of available Zn in soils
7. Estimation of pH and EC in soil water extracts
8. Estimation of Soluble cations in soil water extracts
9. Estimation of Anions in soil water extracts
10. Estimation of Lime requirement in acidic soil
11. Estimation of Gypsum requirement in alkali soils
12. Estimation of N in plants
13. Estimation of P and K in plants

**Suggested readings**

1. Soil Fertility and Fertilizers - Samual Tisdale and Warner Nelson
2. Soil Fertility and Plant Nutrition - Kanwar and Chopra
3. Handbook of Fertilizer and Manures - ICAR Publication