

## **Mission**

Aims to impart Education, Research and Extension for Sustainable Agricultural Development.

## **Vision**

- To develop excellent human resources and innovative technological services to farming community
- To create environment for research knowledge in agriculture and allied fields. .
- To develop culture of continuous improvement, skill development and team work.

## **PROGRAMME OBJECTIVES:**

- To gain knowledge of different streams of agriculture like agronomy, entomology, plant breeding, plant pathology, soil science etc. in practice.
- To study the competent professionally with ethical responsibility as an individual as well as in multidisciplinary teams with positive attitude.
- To devise communication and extension methodologies for transfer of Agricultural Technologies.
- To identify, critically analyzes, formulate and solve agriculture economics and marketing problems to benefit farmers.
- To able to design a system and process to meet desired needs of food and nutrition with the knowledge of protected cultivation and Post-Harvest Technology.

## **PROGRAMME OUTCOMES**

- Agriculture programme is designed to prepare graduates to attain the following outcomes:
- An ability to apply knowledge of different streams of agriculture in practice.
- An ability to critically analyzes and solve marketing problems.
- An ability to design a system to meet desired needs of food and nutrition.
- An ability to devise and conduct experiments, interpret data and provide well informed conclusions.
- An ability to understand the practical problems faced by farmers and to find a proper solution for it.

**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.

**UNIT I**

Chemical (elemental) composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics.

**UNIT II**

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 III**

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 – innersphere 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 IV**

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

## UNIT V

Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity. Chemistry of salt-affected soils and amendments; soil pH,  $EC_e$ , ESP, SAR and important relations; soil management and amendments. 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 conductometric titration of soil humic and fulvic acids
- $(E_4/E_6)$  ratio of soil humic and fulvic acids by visible spectrophotometric studies and the  $\Delta (E_4/E_6)$  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

### Suggested Readings

Bear RE. 1964. *Chemistry of the Soil*. Oxford and IBH.

Bolt GH & Bruggenwert MGM. 1978. *Soil Chemistry*. Elsevier.

- Greenland DJ & Hayes MHB. 1981. *Chemistry of Soil Processes*. John Wiley & Sons.
- Greenland DJ & Hayes MHB. *Chemistry of Soil Constituents*. John Wiley & Sons.
- McBride MB. 1994. *Environmental Chemistry of Soils*. Oxford Univ. Press.
- Sposito G. 1981. *The Thermodynamics of Soil Solutions*. Oxford Univ. Press.
- Sposito G. 1984. *The Surface Chemistry of Soils*. Oxford Univ. Press.
- Sposito G. 1989. *The Chemistry of Soils*. Oxford Univ. Press.
- Stevenson FJ. 1994. *Humus Chemistry*. 2<sup>nd</sup> Ed. John Wiley & Sons.
- Van Olphan H. 1977. *Introduction to Clay Colloid Chemistry*. John Wiley & Sons.

## **AMSC 102 Soil Mineralogy, Genesis, Classification and Survey 2+1 Objective**

To acquaint students with basic structure of alumino-silicate minerals and genesis of clay minerals; soil genesis in terms of factors and processes of soil formation, and to enable students conduct soil survey and interpret soil survey reports in terms of land use planning.

### **Theory**

#### **UNIT I**

Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism.

#### **UNIT II**

Classification, structure, chemical composition and properties of clayminerals; genesis and transformation of crystalline and non-crystalline clayminerals; identification techniques; amorphous soil constituents and other on-crystalline silicate minerals and their identification; clay minerals in Indian soils.

#### **UNIT III**

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 IV**

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 soilmaps – usefulness. 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

### **Suggested Readings**

Brady NC & Weil RR. 2002. *The Nature and Properties of Soils*. 13<sup>th</sup> Ed. Pearson Edu.

Buol EW, Hole ED, MacCracken RJ & Southard RJ. 1997. *Soil*

- Genesis and Classification*. 4<sup>th</sup> Ed. Panima Publ.
- Dixon JB & Weed SB. 1989. *Minerals in Soil Environments*. 2<sup>nd</sup> Ed. Soil Science Society of America, Madison.
- Grim RE. 1968. *Clay Mineralogy*. McGraw Hill.
- Indian Society of Soil Science 2002. *Fundamentals of Soil Science*. ISSS, New Delhi.
- Sehgal J. 2002. *Introductory Pedology: Concepts and Applications*. New Delhi
- Sehgal J. 2002. *Pedology - Concepts and Applications*. Kalyani.
- USDA. 1999. *Soil Taxonomy*. Hand Book No. 436. 2<sup>nd</sup> Ed. USDA NRCS, Washington.
- Wade FA & Mattox RB. 1960. *Elements of Crystallography and Mineralogy*. Oxford & IBH.
- Wilding LP & Smeck NE. 1983. *Pedogenesis and Soil Taxonomy: II. The Soil Orders*. Elsevier.
- Wilding NE & Holl GF. (Eds.). 1983. *Pedogenesis and Soil Taxonomy*. I. *Concept and Interaction*. Elsevier.



# **AMSC 103 Soil Biology and**

## **Biochemistry 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-culturable 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; cycles of important organic nutrients.

#### **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. Biofertilizers – definition, classification, specifications, method of production and role in crop production.

## 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<sub>2</sub> fixation, S oxidation, P solubilization and mineralization of other micro nutrients
- Study of rhizosphere effect

## Suggested Readings

- Alexander M. 1977. *Introduction to Soil Microbiology*. John Wiley & Sons.
- Burges A & Raw F. 1967. *Soil Biology*. Academic Press.
- McLaren AD & Peterson GH. 1967. *Soil Biochemistry*. Vol. XI. Marcel Dekker.
- Metting FB. 1993. *Soil Microbial Ecology – Applications in Agricultural and Environmental Management*. Marcel Dekker.
- Paul EA & Ladd JN. 1981. *Soil Biochemistry*. Marcel Dekker.
- Reddy MV. (Ed.). *Soil Organisms and Litter in the Tropics*. Oxford & IBH.
- Russel RS. 1977. *Plant Root System: Their Functions and Interaction with the Soil*. ELBS & McGraw Hill. 92
- Stotzky G & Bollag JM. 1993. *Soil Biochemistry*. Vol. VIII. Marcel Dekker.
- Sylvia DN. 2005. *Principles and Applications of Soil Microbiology*. Pearson Edu.
- Wild A. 1993. *Soil and the Environment - An Introduction*. Cambridge Univ. Press.

# **AMSC 104 Remote Sensing and GIS Techniques for Soil, Water and Crop Studies 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 geo-statistical techniques with special reference to rigging, 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 interpretations.

### **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 equipments and data products
- Interpretation of aerial photographs and satellite data for mapping of and resources
- Analysis of variability of different soil properties with classical and geo-statistical techniques
- Creation of data files in a database programmes
- 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

### Suggested Readings

- Brady NC & Weil RR. 2002. *The Nature and Properties of Soils*. 13th Ed. Pearson Edu.
- Elangovan K. 2006. *GIS Fundamentals, Applications and Implementations*. New India Publ. Agency.
- Lillesand TM & Kiefer RW. 1994. *Remote Sensing and Image Interpretation*. 3rd Ed. Wiley.
- Nielsen DR & Wendroth O. 2003. *Spatial and Temporal Statistics*. Catena Verloggbh.
- Star J & Esles J. 1990. *Geographic Information System: An Introduction*. Prentice Hall.

## **AMAG 101 Principles and Practices of Water Management**

### **2+1 Objective**

To teach the principles of water management and practices to enhance the water productivity.

### **Theory**

#### **UNIT I**

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 II**

Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition.

#### **UNIT III**

Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; microirrigation system; fertigation; management of water in controlled environments and polyhouses.

#### **UNIT IV**

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

#### **UNIT V**

Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing.

## Practical

- Measurement of soil water potential by using tensiometer, and pressure plate and membrane apparatus
- Soil-moisture characteristics curves. Water flow measurements using different devices
- Determination of irrigation requirements. Calculation of irrigation efficiency
- Determination of infiltration rate. Determination of saturated/unsaturated hydraulic conductivity

## Suggested Readings

- Lenka D. 1999. *Irrigation and Drainage*. Kalyani
- Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.
- Paliwal KV. 1972. *Irrigation with Saline Water*. IARI Monograph, New Delhi.
- Panda SC. 2003. *Principles and Practices of Water Management*. Agrobios.
- Prihar SS & Sandhu BS. 1987. *Irrigation of Food Crops - Principles and Practices*. ICAR.
- Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
- Singh Pratap & Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publ.

# **AMAG 102            Principles and Practices of Organic Farming            2+1**

## **Objective**

To study the principles and practices of organic farming for sustainable crop production.

## **Theory**

### **UNIT I**

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.

### **UNIT II**

Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

### **UNIT III**

Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

### **UNIT IV**

Control of weeds, diseases and insect pest management, biological agents and pheromones and biopesticides.

### **UNIT V**

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and

national economy.

## Practical

- Aerobic and anaerobic methods of making compost. Making of vermicompost
- Identification and nursery raising of important agro-forestry trees and trees for shelter belts
- Efficient use of biofertilizers, technique of treating legume seeds with *Rhizobium* cultures, use of *Azotobacter*, *Azospirillum* and PSB cultures in field visit to an organic farm
- Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms

## Suggested Readings

- Ananthakrishnan TN. (Ed.). 1992. *Emerging Trends in Biological Control of Phytophagous Insects*. Oxford & IBH.
- Gaur AC. 1982. *A Manual of Rural Composting*, FAO/UNDP Regional Project Document, FAO.
- Lampin N. 1990. *Organic Farming*. Press Books, Ipswich, UK.
- Palaniappan SP & Anandurai K. 1999. *Organic Farming – Theory and Practice*. Scientific Publ.
- Rao BV Venkata. 1995. *Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3*, Parisaraprajna Parishtana, Bangalore.
- Reddy MV. (Ed.). 1995. *Soil Organisms and Litter Decomposition in the Tropics*. Oxford & IBH.
- Sharma A. 2002. *Hand Book of Organic Farming*. Agrobios.
- Singh SP. (Ed.) 1994. *Technology for Production of Natural Enemies*. PDBC, Bangalore.
- SubbaRao NS. 2002. *Soil Microbiology*. Oxford & IBH.
- Trivedi RN. 1993. *A Text Book of Environmental Sciences*, Anmol Publ.



Veeresh GK, Shivashankar K & Suiglachar MA. 1997. *Organic Farming and Sustainable Agriculture*. Association for Promotion of Organic Farming, Bangalore.

WHO. 1990. *Public Health Impact of Pesticides Used in Agriculture*. WHO.

Woolmer PL & Swift MJ. 1994. *The Biological Management of Tropical Soil Fertility*. TSBF & Wiley.

# **AMST 101 STATISTICAL METHODS AND APPLIED SCIENCES 2+1**

## **Objective**

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

## **Theory**

### **UNIT I**

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

### **UNIT II**

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

### **UNIT III**

Introduction to theory of estimation and confidence-intervals. Correlation

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

#### **UNIT IV**

Non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run test for the randomness of a sequence. Median test, Kruskal- Wallis test, Friedman two-way ANOVA by ranks. Kendall's coefficient of concordance.

#### **UNIT V**

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

### **Practical**

- Exploratory data analysis, Box-Cox plots;
- Fitting of distributions ~ Binomial, Poisson, Negative Binomial,
- Normal Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F.
- Confidence interval estimation and point

- Estimation of parameters of binomial, Poisson and Normal distribution.
- Correlation and regression analysis, fitting of orthogonal polynomial regression.
- Applications of dimensionality reduction and discriminant function analysis.
- Application of Nonparametric tests.

## Suggested Readings

Anderson TW. 1958. An Introduction to Multivariate Statistical Analysis. John Wiley. Dillon WR & Goldstein M. 1984. Multivariate Analysis - Methods and Applications. John Wiley.

Goon AM, Gupta MK & Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I. The World Press.

Goon AM, Gupta MK & Dasgupta B. 1983. Fundamentals of Statistics. Vol. I. The World Press.

Hoel PG. 1971. Introduction to Mathematical Statistics. John Wiley.

Hogg RV & Craig TT. 1978. Introduction to Mathematical Statistics. Macmillan. Morrison DF. 1976. Multivariate Statistical Methods. McGraw Hill.

Siegel S, Johan N & Casellan Jr. 1956. Non-parametric Tests for Behavior Sciences. John Wiley.

## **AMNC 101 LIBRARY AND INFORMATION SERVICES 0+1**

### **Objective**

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines 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 Online Public Access bibliography; Use of CD-ROM Databases, Online Public Access catalogue and other computerized library services; Use of Internet including search engines and its resources access methods.

## **PGS 502 Technical Writing and communications skills 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- 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, précis citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; paginations, 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); 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.

**Suggested Readings**

Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India. Collins' Cobuild

English Dictionary. 1995. Harper Collins.

Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.

Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.

James HS. 1994. Handbook for Technical Writing. NTC Business Books.

Joseph G. 2000. MLA Handbook for Writers of Research Papers. 8th Ed. Affiliated East-West Press.

Mohan K. 2005. Speaking English Effectively, MacMillan India.

Richard WS. 1969. Technical Writing, Barnes & Noble.

Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek

Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.

Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

**AMNC 102 INTELLECTUAL PROPERTY AND ITS  
MANAGEMENT IN AGRICULTURE**

**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.

**Suggested Readings**

Erbisch FH & Maredia K. 1998 Intellectual Property Rights in Agricultural Biotechnology CABI Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy, McGraw-Hill. Intellectual Property Rights: Key to New Wealth Generation. 2001 NRDC & Aesthetic Technologies Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation Rothschild M & Scott N. (Ed) 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI Saha R. (Ed.). 2006 Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House The Indian Acts-Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003 National Biological Diversity Act, 2003

# AMSC 205 Soil Physics

## 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. Soil texture, textural classes, mechanical analysis, specific surface.

### UNIT II

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

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. 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 IV

Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere



continuum.

## UNIT V

Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management. 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.

### 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

### Suggested Readings

Baver LD, Gardner WH & Gardner WR. 1972. *Soil Physics*. John Wiley & Sons.

Ghildyal BP & Tripathi RP. 2001. *Soil Physics*. New Age International.

Hanks JR & Ashcroft GL. 1980. *Applied Soil Physics*. Springer Verlag.

Hillel D. 1972. *Optimizing the Soil Physical Environment toward*

- Greater Crop Yields*. Academic Press.
- Hillel D. 1980. *Applications of Soil Physics*. Academic Press.
- Hillel D. 1980. *Fundamentals of Soil Physics*. Academic Press.
- Hillel D. 1998. *Environmental Soil Physics*. Academic Press.
- Hillel D. 2003. *Introduction to Environmental Soil Physics*. Academic Press.
- Indian Society of Soil Science. 2002. *Fundamentals of Soil Science*. ISSS, New Delhi.
- Kirkham D & Powers WL. 1972. *Advanced Soil Physics*. Wiley-Interscience.
- Kohnke H. 1968. *Soil Physics*. McGraw Hill.
- Lal R & Shukla MK. 2004. *Principles of Soil Physics*. Marcel Dekker.
- Oswal MC. 1994. *Soil Physics*. Oxford & IBH.
- Saha AK. 2004. *Text Book of Soil Physics*. Kalyani.

# **AMSC 206 Soil Fertility and Nutrient Management**

## **2+1**

### **Objective**

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

### **Theory**

#### **UNIT I**

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions.

#### **UNIT II**

Criteria of essentiality of nutrients; Essential plant nutrients & their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

#### **UNIT III**

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

## UNIT IV

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 interactions.

## UNIT V

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

## Practical

- Determination of soil pH, EC and organic C,
- Determination of total N, available N, P, K and S in soils
- Determination of total N, P, K and S in plants
- Interpretation of interaction effects.
- computation of economic and yield optima.

## Suggested Readings

Brady NC & Weil R.R 2002. *The Nature and Properties of Soils*. 13th Ed. Pearson Edu.

Fageria NK, Baligar VC & Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops*. Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. 7th Ed. Prentice Hall.

Prasad R & Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.

Yawalkar KS, Agrawal JP & Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

# **AMSC 207 Soil, Water and Air**

## **Pollution**

**2+1**

### **Objective**

To make the students aware of the problems of soil, water and air pollution associated with use of soils for crop production.

### **Theory**

#### **UNIT I**

Soil, water and air pollution problems associated with agriculture, nature and extent.

#### **UNIT II**

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 III**

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

#### **UNIT IV**

Pesticides – their classification, behavior in soil and effect on soil microorganism. Toxic elements—their sources, behavior in soils, effect on nutrients availability, effect on plant and human health.

#### **UNIT V**

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

## **Suggested Readings**

- Lal R, Kimble J, Levine E & Stewart BA. 1995. *Soil Management and Greenhouse Effect*. CRC Press.
- Middlebrooks EJ. 1979. *Industrial Pollution Control*. Vol. I. *Agro-Industries*. John Wiley Interscience. Ross SM. *Toxic Metals in Soil Plant Systems*. John Wiley & Sons.
- Vesilund PA & Pierce 1983. *Environmental Pollution and Control*. Ann Arbor Science Publ.

# **AMAG 203 Principle and Practices of Soil Fertility 2+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. 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 III**

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

Micronutrients – critical limits in soils and plants; factors affecting their

availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendations; quantity– intensity relationships; soil test crop response correlations and response functions.

## UNIT V

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

### Suggested Readings

- Brady NC & Weil RR. 2002. *The Nature and Properties of Soils*. 13<sup>th</sup> Ed. Pearson Edu.
- Kabata-Pendias A & Pendias H. 1992. *Trace Elements in Soils and Plants*. CRC Press.
- Kannaiyan S, Kumar K & Govindarajan K. 2004. *Biofertilizers Technology*. Scientific Publ.
- Leigh JG. 2002. *Nitrogen Fixation at the Millennium*. Elsevier.
- Mengel K & Kirkby EA. 1982. *Principles of Plant Nutrition*. International Potash Institute, Switzerland.
- Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. *Micronutrients in Agriculture*. 2<sup>nd</sup> Ed. SSSA, Madison.
- Pierzinsky GM, Sims TJ & Vance JF. 2002. *Soils and Environmental Quality*. 2<sup>nd</sup> Ed. CRC Press.
- Stevenson FJ & Cole MA. 1999. *Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients*. John Wiley & Sons.



Tisdale SL, Nelson SL, Beaton JD & Havlin JL. 1999. *Soil Fertility and Fertilizers*. 5<sup>th</sup> Ed. Prentice Hall of India.

Troeh FR & Thompson LM. 2005. *Soils and Soil Fertility*. Blackwell.

# **AMAG 204 Dryland farming and watershed management 2+1**

## **Objective**

To teach the basic concepts and practices of dry land farming and soil moisture conservation.

## **Theory**

### **UNIT I**

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 drought, 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 for aberrant weather conditions.

### **UNIT IV**

Tillage, tith, 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); anti-transpirants; 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-transparent and their effect on crops
  - Collection and interpretation of data for water balance equations
  - Water use efficiency
  - Preparation of crop plans for different drought conditions
  - Study of field experiments relevant to dryland farming
- Visit to dryland research stations and watershed projects

### Suggested Readings

- Das NR. 2007. *Tillage and Crop Production*. Scientific Publishers.
- Dhopte AM. 2002. *Agrotechnology for Dryland Farming*. Scientific Publ.
- Dhruv Narayan VV. 2002. *Soil and Water Conservation Research in India*. ICAR.
- Gupta US. (Ed.). 1995. *Production and Improvements of Crops for Drylands*. Oxford & IBH.
- Katyal JC & Farrington J. 1995. *Research for Rainfed Farming*. CRIDA.
- Rao SC & Ryan J. 2007. *Challenges and Strategies of Dryland Agriculture*. Scientific Publishers.
- Singh P & Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publishing Company.
- Singh RP. 1988. *Improved Agronomic Practices for Dryland Crops*. CRIDA.
- Singh RP. 2005. *Sustainable Development of Dryland Agriculture in India*.

Scientific Publ.

Singh SD. 1998. *Arid Land Irrigation and Ecological Management*. Scientific Publishers.

Venkateshwarlu J. 2004. *Rainfed Agriculture in India. Research and Development Scenario*. ICAR.

# **AMST 202 EXPERIMENTAL DESIGNS**

**2+1**

## **Objective**

This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

## **UNIT I**

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

## **UNIT II**

Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design.

## **UNIT III**

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment.

## **UNIT IV**

Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design-concepts, randomisation

procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.

## UNIT V

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

## Practical

- Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law;
- Analysis of data obtained from CRD, RBD, LSD;
- Analysis of factorial experiments without and with confounding;
- Analysis with missing data; Split plot and strip plot designs;
- Transformation of data; Analysis of resolvable designs;
- Fitting of response surfaces.

## Suggested Readings

Cochran WG & Cox GM. 1957. Experimental Designs. 2<sup>nd</sup> Ed. John Wiley. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer. Federer WT. 1985. Experimental Designs. MacMillan.

Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.

Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publ.

Pearce SC. 1983. The Agricultural Field Experiment A Statistical Examination of Theory and Practice. John Wiley.

Design Resources Server [www.iasri.res.in/design](http://www.iasri.res.in/design).

## **AMNC 204 BASIC CONCEPTS IN LABORATORY TECHNIQUES 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 vascupets; washing, drying and sterilization of glassware; Drying of solvents chemicals. Weighing and preparation of solutions of different strengths and their dilution Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Prepara Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens incubators, sandbath, waterbath, oilbath; Electric wiring and earthing Preparation of media and methods of sterilization; Seed viability testing testing of pollen viability: Tissue culture of crop plants; Description of owering plants in botanical terms in relation to taxonomy tion of solutions of acids;

### **Suggested Readings**

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

## **AMNC 205 AGRICULTURAL RESEARCH, RESEARCH ETHICS 1+0 AND RURAL DEVELOPMENT PROGRAMMES**

### **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;

#### **UNIT II**

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 III**

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

#### **UNIT IV**

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,

#### **UNIT V**

Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co- operatives, Voluntary Agencies/Non Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

### **Suggested Readings**

Bhalla GS & Singh G. 2001. Indian Agriculture Four Decades of Development. Sage Publ. Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.

Rao BSV. 2007. Rural Development Strategies and Role of Institutions- Issues, Innovations and Initiatives. Mittal Publ.

Singh K. 1998. Rural Development Principles, Policies and Management. Sage





## **AMNC 206 DISASTER MANAGEMENT 1+0**

**(e-Course)**

### **Objectives**

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,

#### **UNIT II**

Climatic change: Global warming, Sea level rise, Ozone depletion.

#### **UNIT III**

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

#### **UNIT IV**

Disaster Management- Efforts to mitigate natural disasters at national and global levels.

#### **UNIT V**

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 force in disaster response; Disaster response: Police and other organizations

### **Suggested Readings**

Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.

Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.

Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.