



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Agriculture

Ph.D. (Ag.) Soil Science

Course Code	Course Name	TEACHING & EVALUATION SCHEME							
		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
PHDSOIL 603	Physical Chemistry of Soil	60	00	40	00	00	2	0	2

1. **Legends:** L - Lecture; P – Practical

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

To impart knowledge about modern concepts of physical chemistry of soils and clays, with emphasis on understanding the processes involved with practical significance.

Theory

UNIT I

Colloidal chemistry of in organic and organic components of soils–their formation, clay organic interaction.

UNIT II

Predictive approaches for cation exchange equilibria- thermodynamics, empirical and diffuse double layer theory (DDL)- relationships among different selectivity coefficients; structure and properties of diffuse double layer.

UNIT III

Thermodynamics of nutrient transformations in soils; Climate change effects on mineralogy and surface properties of variable charge; cationic and anionic exchange and their models, molecular interaction.

UNIT IV

Adsorption/desorption isotherms-Langmuir adsorption isotherm, Freundlich adsorption isotherm, normalized exchange isotherm, BET equation; selective and non-selective adsorption of ions on in organic surfaces and organic surfaces of soil materials (citation of utility in agricultural system).

UNIT V

Common solubility equilibria-carbonates, ironoxide and hydroxides, aluminum silicate, aluminum phosphate; electrochemical properties of clays (citation of examples from agricultural use).

Teaching methods/activities

Classroom teaching with AV aids, group discussion, oral presentation by students.

Learning outcome

Experience on the knowledge of soil chemical behaviour on research for solving field problems.

Suggested Reading

- Bear RE. 1964. Chemistry of the Soil. Oxford & IBH.
- Bolt GH and Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.
- Fried M and Broeshart H. 1967. Soil Plant System in Relation to Inorganic Nutrition. Academic Press.
- Greenland DJ and Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.
- Greenland DJ and Hayes MHB. 1978. Chemistry of Soil Constituents. John Wiley & Sons.
- Jurinak JJ. 1978. Chemistry of Aquatic Systems. Department of Soil Science and Biometeorology, Utah State University
- McBride MB. 1994. Environmental Chemistry of Soils. Oxford University Press.
- Sparks DL. 1999. Soil Physical Chemistry. 2nd Ed. CRC Press.
- Spósito G. 1981. The Thermodynamics of Soil Solutions. Oxford University Press.
- Spósito G. 1984. The Surface Chemistry of Soils. Oxford University Press.
- Spósito G. 1989. The Chemistry of Soils. Oxford University Press.

- Stevenson FJ. 1994. Humus Chemistry. 2nd Ed. John Wiley.
- van Olphan H. 1977. Introduction to Clay Colloid Chemistry. John Wiley & Sons.



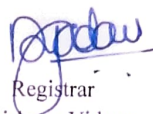
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PHDSOIL 604	Soil Genesis and Micromorphology	60	00	40	00	00	2	0	2

1. Legends: L - Lecture; P – Practical

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

To impart knowledge about the pedogenic processes in soils and to acquaint with the micro-pedological study of soil profile.

Theory

UNIT I

Pedogenic evolution of soils; soil composition and characterization.

UNIT II

Weathering and soil formation–factors and pedogenic processes

UNIT III

Stability and weathering sequences of minerals.

UNIT IV

Assessment of soil profile development by mineralogical and chemical analysis.

UNIT V

Micro-pedological features of soils–their structure, fabric analysis, role in genesis and classification.

Teaching methods/activities

Classroom teaching with AV aids, group discussion, oral presentation by students.

Learning outcome

Experience on the knowledge of soil micro pedology and soil taxonomy on research for solving field problems.

Suggested Reading

- Brady NC and Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
- Buol EW, Hole ED, MacCracken RJ & Southard RJ. 1997. Soil Genesis and Classification. 4th Ed. Panima Publ.
- Dixon JB and Weed SB. 1989. Minerals in Soil Environments. 2nd 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. 2nd Ed. USDA NRCS, Washington.
- Wade FA and Mattox RB. 1960. Elements of Crystallography and Mineralogy. Oxford & IBH.

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PHDSOIL 605	Biochemistry of Soil Organic Matter	60	00	40	00	00	2	0	2

1. **Legends:** L - Lecture; P – Practical

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

To impart knowledge about the pedogenic processes in soils and to acquaint with the micro-pedological study of soil profile.

Theory

Unit I

Organic matter in soils and its maintenance Role of organic matter in soil productivity; humus levels in soils; current thinking on the maintenance of organic matter in the soils. Carbon retention and sequestration.

Unit II

Biochemistry of the humus formation; different pathways for humus synthesis in soil; soil carbohydrates and lipids.

Unit III

Nutrient transformation–N, P, S; trace metal interaction with humic substances, significance of chelation reactions in soils.

Unit IV

Reactive functional groups of humic substances, adsorption of organic compounds by clay and role of organic substances in pedogenic soil aggregation processes; clayorganic matter complexes.

Unit V

Humus-pesticide interactions in soil, mechanisms.

Teaching methods/activities

Classroom teaching with AV aids, group discussion, oral presentation by students.

Learning outcome

Experience on the knowledge of soil biochemistry on research for solving field problems.

Reading Materials

- Lynch JM, Willey JM. Soil Biotechnology.
- Paul EA and Clark FE. Soil Microbiology and Biochemistry
- Sherwood LM and Woolverton CJ. Prescott's Microbiology.
- Subba Rao NS. Advances In Agricultural Microbiology

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PHDSOIL 606	Soil Resource Management	60	00	40	00	00	3	0	3

1. **Legends:** L - Lecture; P – Practical

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

To impart the students basic holistic knowledge on soil resource and latest developments in its sustainable use.

Theory

UNIT I

Relevance of soil management to sustainable agriculture; soil as a natural resource for biomass production, filtering, buffering, transportation of solutes, genereserves, and geogenic source of raw materials; soil as a source and sink of greenhouse gases.

UNIT II

Concept of sustainable land management (SLM); spatial variability of soils; soil quality and food security; soil quality indices, conservation agriculture in relation to soil quality; soil resilience and resistance.

UNIT III

Types, factors and causes of land degradation and desertification; GLASOD classification; application of GIS and remote sensing in monitoring, diagnosis and mapping land degradation; history, distribution, identification and description of soil erosion problems in India; forms of soil erosion; impact of soil erosion-on-site and off-site effects; strategies for erosion control and conservation; soil conservation in hilly, arid, semiarid, coastal and diarlalands. Management of forest, peat and muck soils.

UNIT IV

Soil conservation planning; land capability classification; soil conservation in special problem are as such as hilly, arid and semi-arid regions, waterlogged and wetlands; land restoration and conservation techniques–erosion control, reclamation of salt affected soils; mine land reclamation, afforestation, organic products, soil fauna and biodegradation.

UNIT V

Watershed management-concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socio-economic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds. Agro-ecological regions of India; potentials and constraints of soils of different regions; land evaluation and rationalizing land use, decision support system with relation to land management; national and international soil policy considerations.

Teaching methods/activities

Classroom teaching with AV aids, group discussion, oral presentation by students.

Learning outcome

Experience on the knowledge of soil resources on research for solving field problems.

Suggested Reading

- Abrol IP and Dhruvanarayana VV. 1990. Technology for Wasteland Development. ICAR, New

Delhi.

- Andriess JP. 1988. Nature and Management of Tropical Peat Soils, Soil Resources, FAO Soils Bulletin 59, Management and Conservation Service, Land and Water Development Division, FAO, Rome
- Blackwell, Dent D and Young A. 1981. Soil Survey and Land Evaluation. George Allen and Unwin, London.
- Burrough A and McDonnell RK. 1998. Principles of Geographical Information System. Oxford University Press.
- Dan Binkley D and Fisher R. 2012. Ecology and Management of Forest Soils, 4th Edition, Wiley.
- FAO. 1996. Land Quality Indicators and their Use in Sustainable Agriculture and Rural Development. FAO Land and Water Bulletin.5. FAO, Rome.
- Farooq M and Siddique K. (Ed.). 2015. Conservation Agriculture, Springer Nature, Chennai, India.
- FESL. 1993. An International Framework for Evaluating Sustainable Land Management, FAO World Soil Resources Report No. 73, Land Development Division, FAO, Rome.
- ISSS. 1994. Management of Land and Water Resources for Sustainable Agriculture and Environment. Diamond Jubilee Symposium Publication, Indian Society of Soil Science, New Delhi.
- Lal R, Blum WEH, Valentine C and Stewart BA. (Editors). 1988. Methods for Assessment of Soil Degradation. CRC Press, Boca Raton.
- Mulders MA. 1987. Remote Sensing in Soil Science. Elsevier Science Publishers, Amsterdam.
- Sehgal J. 2014. A Text Book of Pedology Concepts and Application. Kalyani publishers, New Delhi.
- SSSA 1996. Methods for Assessing Soil Quality. SSSA Publication Number 49, Madison, Wisconsin.



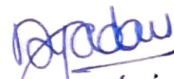
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PHDAGRON606	Soil Conservation and Watershed Management	60	00	40	30	20	2	1

1. **Legends:** L - Lecture; P – Practical

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class

Objective

To teach about different soil moisture conservation technologies for enhancing the agricultural productivity through holistic approach watershed management.

Theory

UNIT I

Soil erosion: definition, nature and extent of erosion; types of erosion, factors affecting erosion.

UNIT II

Soil conservation: definition, methods of soil conservation; agronomic measures - contour cultivation; strip cropping, cover crops; mulching, tillage, cropping system vegetative barriers; improved dry farming practices; mechanical measures - bunding, gully control, bench terracing; role of grasses and pastures in soil conservation; wind breaks and shelter belts.

UNIT III

Watershed management: definition, objectives, concepts, approach, components, steps in implementation of watershed; development of cropping systems for watershed areas.

UNIT IV

Land use capability classification, alternate land use systems; agro-forestry; ley farming; jhum land management - basic concepts, socio-ethnic aspects, its layout.

UNIT V

Drainage, methods of drainage, Drainage considerations and agronomic management; rehabilitation of abandoned jhum lands and measures to prevent soil erosion.

Practical

- Study of different types of erosion
- Determination of dispersion ratio
- Estimation of soil loss by Universal Soil Loss Equation
- Estimation of soil loss by wind erosion
- Measurement of runoff and soil loss
- Field studies of different soil conservation measures
- Laying out run-off plot and deciding treatments
- Identification of different grasses and trees for soil conservation
- Visit to watershed areas
- Visit to a soil conservation research centre, demonstration and training centre.

Teaching methods/activities

Classroom teaching with AV aids, group discussion, oral presentation by students.

Learning outcome

Experience on the knowledge of soil moisture conservation technologies for enhancing the agricultural productivity through holistic approach watershed management.

Reading Materials

Arakeri HR and Roy D. 1984. Principles of Soil Conservation and Water Management. Oxford & IBH.

- Dhruvanarayana VV. 1993. Soil and Water Conservation Research in India. ICAR.
- FAO. 2004. Soil and Water Conservation in Semi-Arid Areas. Soils Bull., Paper 57.
- Frederick RT, Hobbs J, Arthur D and Roy L. 1999. Soil and Water Conservation: Productivity and Environment Protection. 3rd Ed. Prentice Hall



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		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
PHDSTAT 522	Data Analysis Using Statistical Packages	60	00	40	30	20	2	1	3

1. **Legends:** L - Lecture; P – Practical

2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Objective

This course is meant for exposing the students in the usage of various statistical packages for analysis of data. It would provide the students a hands on experience in the analysis of their research data. This course is useful to all disciplines.

UNIT I

Introduction to various statistical packages: Excel, R, SAS, SPSS. Data Preparation; Descriptive statistics; Graphical representation of data, Exploratory data analysis.

UNIT II

Test for normality; Testing of hypothesis using chi-square, t and F statistics and Z-test.

UNIT III

Data preparation for ANOVA and ANCOVA, Factorial Experiments, contrast analysis, multiple comparisons, Analyzing crossed and nested classified designs.

UNIT IV

Analysis of mixed models; Estimation of variance components; Correlation and regression analysis, Probit, Logit and Tobit Models.

UNIT V

Discriminant function; Factor analysis; Principal component analysis; Analysis of time series data, Fitting of non-linear models; Neural networks.

Practical

- Use of software packages for summarization and tabulation of data, obtaining descriptive statistics, graphical representation of data.
- Testing the hypothesis for one sample t-test, two sample t-test, paired t-test, test for large samples - Chi-squares test, F test, one-way analysis of variance.
- Designs for Factorial Experiments, fixed effect models, random effect models, mixed effect models, estimation of variance components.
- Linear regression, Multiple regression, Regression plots.
- Discriminant analysis - fitting of discriminant functions, identification of important variables.
- Factor analysis. Principal component analysis - obtaining principal component.

Suggested Reading

- Anderson C.W. and Loynes R.M. 1987. Teaching Practical Statistics. John Wiley.
- Atkinson A.C. 1985. Plots Transformations and Regression. Oxford University Press.
- Chambers J.M., Cleveland W.S., Kleiner B and Tukey P.A. 1983. Graphical Methods for Data Analysis. Wadsworth, Belmont, California.

- Chatfield C. 1983. Statistics for Technology. 3rd Ed. Chapman & Hall. Chatfield C. 1995. Problem Solving: A Statistician's Guide. Chapman & Hall.
- Cleveland W.S. 1985. The Elements of Graphing Data. Wadsworth, Belmont, California.
- Ehrenberg ASC. 1982. A Primer in Data Reduction. John Wiley.
- Erickson B.H. and Nosanchuk T.A. 1992. Understanding Data. 2nd Ed. Open University Press, Milton Keynes.
- Snell E.J. and Simpson HR. 1991. Applied Statistics: A Handbook of GENSTAT Analyses. Chapman and Hall.
- Sprent P. 1993. Applied Non-parametric Statistical Methods. 2nd Ed. Chapman & Hall.
- Tufte ER. 1983. The Visual Display of Quantitative Information. Graphics Press, Cheshire, Conn.
- Velleman PF and Hoaglin DC. 1981. Application, Basics and Computing of Exploratory Data Analysis. Duxbury Press.
- Weisberg S. 1985. Applied Linear Regression. John Wiley.
- Wetherill GB. 1982. Elementary Statistical Methods. Chapman & Hall.
- Wetherill GB. 1986. Regression Analysis with Applications. Chapman & Hall.
- Cleveland WS. 1994. The Elements of Graphing Data, 2nd Ed., Chapman & Hall



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