

COURSE CATALOGUE & SYLLABUS

FOR

M.Sc. (SOIL SCIENCE)



DEPARTMENT OF SOIL SCIENCE

SCHOOL OF FORESTRY & ENVIRONMENT

SHIATS – DEEMED UNIVERSITY
ALLAHABAD – 211007, UTTAR PRADESH

M. Sc. Soil Science

A – Core- Courses

Course Code	Course Title	Credits
SES - 710	Soil Physics	3(2+1)
SES - 711	Soil Genesis and Mineralogy	3(2+1)
SES - 701	Inorganic Chemistry	3(2+1)
SES - 729	Soil Chemistry	4(3+1)
SES - 713	Soil Fertility and Plant Nutrition	3(2+1)
SES - 714	Soil Taxonomy	3(2+1)
SES - 712	Geo- Chemistry	3(2+1)

B - Minor / Specialization / Optional Courses (Minimum 10 Credits)

Course Code	Course Title	Credits
SES - 818	Soil fertility and fertilizers	3(2+1)
SES - 821	Environmental Pollution	3(2+1)

C - Supporting Courses (Minimum 05 Credits)

Course Code	Course Title	Credits
MAS - 714	Statistics – 1 st	3(2+1)
COMP - 705	Computer Application	3(2+1)
MAS - 715	Statistics – 2 nd	3(2+1)

D - Seminars and Research

Course Code	Course Title	Credits
SES - 980	Seminar I	1(0+1)
SES – 981	Seminar II	1(0+1)
SES – 899	Research	15

M.Sc. Soil Science

1st Semester

S. No.	Course Code	Title of Course	Credits
1	SES - 710	Soil Physics	3(2+1)
2	SES - 711	Soil Genesis and Mineralogy	3(2+1)
3.	SES - 701	Inorganic Chemistry	3(2+1)
4.	MAS - 714	Statistics – 1 st	3(2+1)
5.	COMP - 705	Computer Application	3(2+1)

2nd Semester

S. No.	Course Code	Title of Course	Credits
1	SES - 729	Soil Chemistry	4(3+1)
2	SES - 713	Soil Fertility and Plant Nutrition	3(2+1)
3.	SES - 714	Soil Taxonomy	3(2+1)
4.	MAS - 715	Statistics – 2 nd	3(2+1)
5.	SES - 780	Seminar - I	1

3rd Semester

S. No.	Course Code	Title of Course	Credits
1	SES - 712	Geo- Chemistry	3(2+1)
2	SES - 818	Soil fertility and fertilizers	3(2+1)
3.	SES - 821	Environmental Pollution	3(2+1)
4.	SES - 781	Seminar - II	1

4th Semester

S. No.	Course Code	Title of Course	Credits
1	SES - 899	Dissertation / Thesis	15

Deficiency Courses offered for M. Sc. Soil Science Students

S. No.	Course Code	Title of Course	Credits
1	SES - 401	Principle of Soil Science	3(2+1)
2	AGRN - 401	Principle of Agronomy	3(2+1)
3	AGRN - 402	Practical Crop Production	1(1+0)
4	ECON - 504	Farm Management	2(2+1)
5	MBMT - 609	Agricultural Microbiology	3(2+1)
6	SES - 503	Soil Physics	3(2+1)
7	SES - 402	Water Science	3(2+1)

S. No.	Course Code	Title of Course	Credits
1	SES - 415	Environmental Studies	2(2+0)
2	SES - 406	Introduction to Forest Soil	3(2+1)
3.	SES - 327	Soil Chemistry, Fertilizers and Integrated Nutrient Management	3(2+1)
4.	FBL - 402	Fundamental of forest pathology	3(2+1)
5.	SES - 506	Geo-Chemistry	2(1+1)

Note: From the third semester student will come to main stream of courses offered by Department of Soil Science, for the degree of M. Sc. in Soil Science

Course Code:
SES-710

Course Title:
Soil Physics

Credit Hrs:
3 (2+1)

Lecture Schedule:

Theory

•	Definition and composition of soil.	1
•	Soil as three phase system (solid, liquid and gas).	1
•	Soil texture, Influence of soil texture on soil properties.	1
•	Various methods of estimation of soil texture.	1
•	Triangular textural diagram with their plotting practice.	1
•	Classification according to various systems, Stoke's law.	1
•	Soil mineralogical composition.	1
•	Clay and its classification.	1
•	Soil Structure and soil aggregation.	1
•	Classification of soil structure.	1
•	Factors influencing soil structures and plant growth.	1
•	Bulk density, Particle density and Porosity.	1
•	Factors Influencing Bulk density, Particle density and Porosity.	1
•	Soil consistency, Cohesion, Adhesion.	1
•	Forms of consistency, Factor influencing soil consistency, Plasticity.	1
•	Atterberg's constant.	1
•	Mid - Semester Examination	
•	Soil moisture, Forms of soil water.	1
•	Water – energy concept, Soil moisture potential, Darcy's law.	1
•	Water flow in saturated and unsaturated soil.	1
•	Infiltration, Redistribution, Evaporation, Water balance in field.	1
•	Soil Moisture Characteristic Curve. Hystereses.	1
•	Soil water movement.	1
•	Saturated Flow, Unsaturated Flow, Hydraulic Conductivity.	1
•	Flocculation and Dispersion.	1
•	Distribution of Sub- surface water.	1
•	Soil moisture belt and capillary.	1
•	Soil air and its composition, Significance.	1
•	Factor Influencing Soil Air Composition.	1
•	Diffusion, Mass flow and ODR with their calculation.	1
•	Effect of soil aeration on plant growth.	1
•	Soil temperature and its importance, Thermal properties of soil.	1
•	Factors influencing soil temperature.	1
•	Effect of soil temperature on soil properties and on plant growth.	1
•	Total Numbers of Period	34

Practical:

•	Soil Sampling.	1
•	Preparation of soil samples for physical analysis.	1
•	Textural analysis of soil by feel method.	1
•	Textural analysis of soil by bouyoucus hydrometer method.	1
•	Estimation of bulk density.	1

•	Estimation of particle density.	1
•	Estimation of pore space.	1
•	Estimation of different methods of soil moisture content in the soil.	1
•	Estimation of hydraulic conductivity.	1
•	Estimation of Infiltration rate.	1
•	Estimation of aggregate analysis by dry sieving method.	1
•	Estimation of aggregate analysis by wet sieving method.	1
•	Estimation of field capacity.	1
•	Estimation of moisture equivalent	1
•	Estimation of wilting point, hygroscopic coefficient,	1
•	Estimation of water available for plant growth.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

Baver, L. D., Gardner, W. H. and Gardner, W. R. 1972. Soil Physics. John Wiley, New York.

Oswal, M. C. 1994. Soil Physics –Oxford IBH, New Delhi.

Hanks and Ascheroff. 1980. Applied Soil Physics. Springer– Verlag, Berlin.

Hillel, D. 1998. Environmental Soil Physics. Academic Press, New York.

Hillel, D. 1982. Introduction to Soil Physics. Academic Press, New York.

Hillel, D. 1980. Application of Soil Physics. Academic Press, New York.

Khanke, H. 1968. Soil Physics. McGraw Hill Publishing Co., New Delhi.

Kirkham, D. and Powers, W. L. 1972. Advanced Soil Physics. Wiley Interscience.

Ghildyal, B. P., K. P. Tripathi. 1987. Soil Physics. Wiley Eastern Limited, New Delhi.

Course Code:

SES- 711

Course Title:

Soil Genesis and Mineralogy

Credit Hrs:

3 (2+1)

Lecture Schedule:

Theory

•	History and concepts of soil genesis.	1
•	Factors of soil formation.	1
•	Soil forming Processes (active and passive factors).	1
•	Soil profile and it's Nomenclature, Soil profile development.	1
•	Soil forming processes responsible for the development of different soil orders (USDA system).	1
•	Classification and nomenclature of soil, Laterization, Podsolization, Gleization	1
•	Weathering of rocks (Definition and its classification).	1
•	Weathering of minerals (Definition and its classification).	1
•	Soil Classification – Properties and objectives – units of soil classification.	1
•	Early and modern systems of soil classification.	1
•	World soil groups, Soils of India and Uttar Pradesh.	1
•	Soil minerals – structure, classification, characterization, distribution.	1
•	Genesis and classification of clay mineral.	1
•	Non-crystalline components of soil.	1
•	Soil horizon and their identification in the field.	1
•	Color – base color and mottling.	1
•	Mid - Semester Examination	
•	Textural classes, soil structure, nodules and concretions.	1
•	Voids (pores), horizon boundaries.	1
•	Horizons continuity with in the pedon.	1
•	Soil horizon designation, definition and morphology.	1
•	Lithological discontinuities.	1
•	Diagnostic horizons for classification.	1
•	Epipedon.	1
•	Subsurface diagnostic horizons.	1
•	Soil micro morphology.	1
•	Factors of soil formation.	1
•	Parent material relief, climate, time and organisms.	1
•	Pedogenic Processes.	1
•	Internal soil building processes.	1
•	Soil monolith.	1
•	Genesis and transformation of clay minerals.	1
•	History and systems of soil classification.	1
•	Taxonomy of soil of India and Uttar Pradesh.	1
•	Total Numbers of Period	34

Practical:

•	Identification and characterization of different rocks.	1
•	Identification and characterization of different minerals.	1
•	Excavation of soil profile and its study.	1
•	Preparation of soil monolith.	1

•	Identification of soil forming minerals.	1
•	Methods of sampling disturbed and undisturbed soil – for lab studies.	1
•	Study of soil profile.	1
•	Collection of profile soil samples.	1
•	Minerals identification under microscope.	1
•	Analysis of coarse and fine sand fraction, clay and silt fractions.	1
•	Determination of pH and EC in soil.	1
•	Determination of %OC in soil.	1
•	Determination of Ca and Mg in soil.	1
•	Determination of Na and K in soil.	1
•	Determination of Fe and Al. in soil.	1
•	Visit to different site for study different soil profile.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Boul, S. W., F. B. Hole and R. J. McCracken, 1980. Soil Genesis and Classification. Oxford and IBH Publishing Co, New Delhi.

Bridges, E. M. 1978. World Soils. Cambridge University Press, Cambridge, London

Jenny, H. 1941. Factors of soil Formation – A system of quantitative Pedology. McGraw- Hill book Company INC. New York.

Joffe, J. S. 1936. The ABC of Soils. Pedology Publication, New Jersey.

Joffe, J. S. 1949. Pedology. Rutgers University Press, New Jersey.

Soil Survey staff, 1981. Soil survey manual. UADA Hand Book 18, Soil conservation service, USDA.

Buol, S. W., F. D. and McChackeni, R. J. 1995. Soil Genesis and Classification. East West Press, New Delhi, pp. 360.

Grim, R. E. 1968. Clay Mineralogy. McGraw Hill, New York, pp. 384.

Sehgal, J. 1986. Introductory Pedology, Concepts and application. Kalyani, New Delhi, pp. 485.

USDA 1998. Keys to Soil Taxonomy (8th edn). Oxford and IBH, New Delhi, pp. 326.

Wade, F. A. and Mattox, R. B. Elements of Crystallography and Mineralogy. Oxford and IBH, New Delhi, pp. 331.

Wilding, L. P., Smeck, N. E. and Holl G. F. 1983. Pedogenesis and soil Taxonomy, II. The soil Orders. Elsevier Science., Pub., New York, pp 410.

Course Code:

SES – 701

Course Title:

Inorganic Chemistry

Credit Hrs:

3 (2+1)

Lecture Schedule:**Theory**

•	Structure of atom, Rutherford's model, Bohr model of atom.	2
•	Chemical periodicity	1
•	Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules	2
•	Concepts of acids and bases	1
•	Chemistry of the main group elements and their compounds	2
•	Allotropy, synthesis, bonding and structure	1
•	Chemistry of transition elements and coordination compounds	1
•	Bonding theories.	1
•	Spectral and magnetic properties.	1
•	Reaction mechanisms.	1
•	Inner transition elements.	1
•	Spectral and magnetic properties.	1
•	Analytical Applications.	1
•	Organometallic compounds - synthesis, bonding, structure and reactivity.	2
•	Organometallics in homogenous catalysis	1
•	Cages and metal clusters	1
•	Mid - Semester Examination	
•	Analytical chemistry- separation techniques	1
•	Spectroscopic electro- and thermo-analytical methods	1
•	Bioinorganic chemistry – photosystems, porphyrines, metalloenzymes, oxygen transport.	3
•	Electron- transfer reactions.	1
•	Nitrogen fixation.	1
•	Physical characterization of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-, NQR, MS,	3
•	Electron spectroscopy and microscopic techniques.	1
•	Nuclear chemistry – nuclear reactions	1
•	Nuclear fission and fusion.	1
•	Radio-analytical techniques and activation analysis.	1
•	Total Numbers of Period	34

Practical:

•	Acid Titration.	1
•	Base Titration.	1
•	Oxidation Titration.	1
•	Reduction Titration.	1
•	Estimation of calcium in solution.	1
•	Estimation of Magnesium in solution.	1
•	Estimation of Iron in solution.	1
•	Instrumental analysis of inorganic constituents.	1
•	Principles of spectrophotometer.	1

•	Principles of Flame photometer.	1
•	Analysis of cations in solution.	1
•	Estimation of iron (III) by photo chemical reduction method.	1
•	Determination of calcium hardness and magnesium hardness of water sample.	1
•	Determination of chloride in a sample of water (silver nitrate method).	1
•	Determination of calcium hardness and magnesium hardness of water sample,	2
•	Determination of chloride in a sample of water (silver nitrate method).	1
•	Total Numbers of Period	17

Reference:

1. Inorganic chemistry, principles of structure and reactivity, 4th Edition by James E. Huheey: Elleu A. Keiter: Richard L. Keiter.
2. Advanced inorganic chemistry by F.A. Cotton and G. Wilkinson.
3. Theoretical Inorganic Chemistry by Day and Selbin.
4. Concepts and Models in Inorganic Chemistry by Douglas Mc Daniel.
5. Introductory Quantum Chemistry by A.K. Chandra (Tata McGrawhill)
6. Chemistry of Lanthanides by T. Healler, Chapman and Hall.
7. Chemical Applications of Group Theory by B.A. Cotton.
8. Basic concepts of Nuclear Chemistry by R.T. Overmann.
9. Introduction to Nuclear Science by M.N. Sastri, East West Press, Madras.

Course Code:
SES – 714

Course Title:
Statistics – 1st

Credit Hrs:
3 (2+1)

Lecture Schedule:

Theory

•	Statistical Methods.	1
•	Measures of Skewness.	1
•	Measures of Kurtosis.	1
•	Standard error of mean.	1
•	Coefficient of variation.	1
•	Definition and Theory of Probability.	1
•	Addition and multiplication rules of probability.	2
•	Conditions of probability.	1
•	Probability distribution.	1
•	Normal distribution of Probability.	2
•	Binomial distribution of Probability.	1
•	Poisson distributions of Probability.	1
•	Correlation.	1
•	Regression.	1
•	Simple correlation rank.	2
•	Correlation regression coefficient.	2
•	Mid - Semester Examination	
•	Multiple and partial correlation regression lines between two variables.	2
•	Multiple regressions.	1
•	Test of significant X^2 – test.	1
•	Test of significant t- test, t- test one sample.	2
•	Two sample t-test.	2
•	Paired t-test.	1
•	Testing of correlation coefficient.	1
•	Standard normal variable test.	1
•	F – test.	1
•	Fisher's 2 – transformation.	2
•	Total Numbers of Period	34

Practical:

•	Coefficient of variation	1
•	SE of mean.	1
•	Skewness.	1
•	Kurtosis.	2
•	Fitting of normal.	2
•	Binomial distribution.	2
•	Poisson distribution.	1
•	Regression lines between two variables.	2
•	X^2 – test.	1
•	t- test.	1
•	F – test.	1
•	Fisher's 2 – transformation.	2

•	Total Numbers of Period	17
---	--------------------------------	-----------

Reference Books:

Bernard Ostle and R.W. Mensing, Statistics in Research.

C.H. Goulden, Method of Statistical Analysis.

G.W. Snedecor and W.G. Cochran, Statistical Methods.

R.G. Steel and J.H. Torrie, Principles and Procedures of Statistics (with special reference to Biological Sciences)

R. Rangaswamy., A Text Book of Agricultural Statistics.

Chandel S.R.S, A Text Book of Agricultural Statistics.

W.G. Cochran and G.M.Cox, Experimental Designs.

Course Code:

COMP- 705

Course Title:

Computer Application

Credit Hrs:

3(2+1)

Lecture Schedule:

Theory

•	Introduction to computer.	1
•	Computer organization and peripherals.	2
•	Hardware.	2
•	Software.	2
•	Concept and terminology of hardware and software.	1
•	Working in DOS.	3
•	Working in WINDOWS.	2
•	Environment introduction to network of computers.	2
•	Algorithms.	2
•	Mid - Semester Examination	
•	Flow charts.	1
•	Program development.	1
•	Steps in development of an application.	1
•	Information management such as data storage.	1
•	Information management such as retrieval.	1
•	Information management such as data validation.	1
•	Information management such as data security.	1
•	Information management such as data manipulation.	2
•	Information management such as data presentation.	1
•	Information management such report generation.	1
•	Introduction to commonly used software application packages.	2
•	Familiarization with commonly used application packages like RDBMS.	1
•	Familiarization with commonly used application packages like MS-Office.	2
•	Familiarization with commonly used application packages like Word Processing etc.	1
•	Total Numbers of Period	34

Practical:

•	Practicing DOS commands.	3
•	Running a given application on a computer.	2
•	Practice with MS-office.	3
•	Practice with MS-word.	3
•	Practice with MS-excel.	3
•	Practice with d BASE.	3
•	Total Numbers of Period	17

References

ABCs of Excel 97, Gene Weisskop,

The Compact Guide to Microsoft Office, Ron Mansfield,

Programming languages - Design and implementation, Terrence W. Pratt and Marvin V. Zelkowitz.

Programming with C, Bryon Gottfried

Let us C, Yashwant Kanetkar

Course Code:

SES-29

Course Title:

Soil Chemistry

Credit Hrs:

3(2+1)

Lecture Schedule:

Theory

•	Concept of Chemical equilibria in soils.	1
•	Soil Colloids.	1
•	Solubility relationship of important nutrient.	2
•	Aluminosilicates in soils.	2
•	Salt dissolution and precipitation.	1
•	Organic matter and characterization.	1
•	Clay organic matter interaction.	2
•	Ion retention mechanism.	1
•	Chemical and empirical relationships.	2
•	Chemical and electrochemical properties of submerged soils.	2
•	Chemistry of acid soils.	1
•	Chemistry of salt affected soils.	2
•	Reclamation of acid and salt affected soils.	2
•	Nutrient dynamics.	2
•	Ion exchange phenomenon in soils.	2
•	Ion effect by chemical equilibrium in soil.	2
•	Mid - Semester Examination	
•	Soil reactions.	1
•	Buffering Capacity of Soil.	1
•	Salt dissolution.	1
•	Oxidation reduction reaction.	2
•	Soil colloid.	1
•	Colloids and precipitation.	2
•	Organic matter.	1
•	Clay organic matter interaction.	2
•	Ion retention mechanism.	2
•	Chemistry of weathering.	2
•	Calcification and decalcification condition.	1
•	Chemical process involved effect of carbon dioxide podzolization, laterization.	2
•	Chemical measurement of Soil pH.	1
•	Chemical measurement of CEC.	1
•	Chemical measurement of exchangeable acidity.	2
•	Chemical measurement of Soil buffering capacity.	2
•	Surface chemistry.	1
•	Total Numbers of Period	34

Practical:

•	Analysis of equilibrium soil solution for pH.	1
•	Analysis of equilibrium soil solution for EC.	1
•	Analysis of equilibrium soil solution for CEC.	1
•	Analysis of equilibrium soil solution for SAR.	1

•	Determination of ion activity.	1
•	Common ion effects on solubility.	1
•	Exchange reactions of Na in soils.	1
•	Exchange reactions of K in soils.	1
•	Exchange reactions of Ca in soils.	1
•	Exchange reactions of Mg in soils.	1
•	Gypsum requirement.	1
•	Lime requirement.	1
•	Estimation of chemical properties of clay.	1
•	Nitrogen fixation by clay.	1
•	Phosphorus fixation by clay.	1
•	Potassium fixation by clay.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

- Bear, R. E. 1964. Soil Chemistry. Oxford and IBH Pub. Co., New Delhi, pp 515.
 Bear, F. E. 1965. Chemistry of Soil. Oxford and IBH Pub. Co., Calcutta.
 Frid, M. and Broeshart, H. 1967. Soil plant System , Academic Press, New York, pp.358.
 Greenland, D. J. and Hayes, M. H. B. 1978. Chemistry of Soil constituents. John Wiley and Sons, pp714.
 Stevenson, F. J. 1982. Humus Chemistry. John Wiley, New York, pp443.
 Van Olphan. H.1977. Introduction to clay colloid chemistry. John Wiley and Sons, New York, pp318.
 Tan , K. H. 1982. Principles of Soil Chemistry. Marcel Dekker INC., New York.

Course Code:

SES-713

Course Title:

Soil Fertility and Plant Nutrition

Credit Hrs:

3(2+1)

Lecture Schedule:

Theory

•	Forms of macro and micro nutrients in soils.	1
•	Availability of macro and micronutrients in soils.	1
•	Mobility of macro and micronutrients in soils.	1
•	Losses of macro and micronutrients in soils.	1
•	Nutrient deficiencies in soil.	1
•	Nutrient toxicities in soil.	1
•	Recent diagnostic techniques of nutrient toxicity.	1
•	Recent ameliorative measures of nutrient toxicity.	1
•	Nutrients and nutrient – water interactions.	1
•	Balanced use of nutrients.	1
•	Integrated plant nutrient supply.	1
•	Integrated plant nutrient management.	1
•	Nutrient uptake mechanisms.	1
•	Nutrient release and carry over effects.	1
•	Quantity intensity relationships.	1
•	Soil fertility evaluation.	1
•	Mid - Semester Examination	
•	Soil test crop response.	1
•	Correlations and response functions soil test crop.	1
•	Essential plant nutrients.	1
•	Criteria for essentiality of plant nutrients.	1
•	Soil pH and availability of nutrients.	1
•	Soil fertility.	1
•	Soil fertility- concept and evaluation.	1
•	Ion absorption.	1
•	Role of plant roots and foliar parts.	1
•	Mechanism of movement of nutrients in soil.	1
•	Mechanism of movement of nutrients to plant.	1
•	Deficiency symptoms of plant nutrients.	1
•	Diagnostic techniques of nutrient deficiency.	1
•	Nutrient toxicities.	1
•	Nutrients release effects.	1
•	Nutrients carry over effects.	1
•	Nutrient uptake mechanism.	1
•	Total Numbers of Period	34

Practical:

•	Estimation of N in soil and their critical value in soils.	1
•	Estimation of P in soil and their critical value in soils.	1
•	Estimation of K in soil and their critical value in soils and plants.	1
•	Estimation of N in plant samples and their critical value in plants.	1

•	Estimation of P in plant samples and their critical value in plants.	1
•	Estimation of K in plant samples and their critical in plants.	1
•	Determination of different pools of macro and micronutrients.	1
•	Quantity- intensity relations of P and K.	1
•	Estimation of S in soil.	1
•	Estimation of Zn in soil.	1
•	Estimation of B in soil.	1
•	Estimation of Cu in soil.	1
•	Estimation of S and Zn in plants.	1
•	Estimation of B and Cu in plants.	1
•	Qualitative and quantitative estimation of soil nutrients (N,P andK) in Fertilizers.	1
•	Fertilizer analysis and quality control.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

- Barber, S. A. 1984. Soil nutrient bioavailability. John Wiley, New York, pp389.
- Cooke, G. W. 1967. The control of soil fertility . Crossby Lockwood and Sons, London, pp.526.
- Epstein, E. 1978. Mineral Nutrition of Plants- Principles and Perspectives. Wiley Eastern New Delhi, pp.412
- Lindsay, W.L. 1979. Chemical Equilibria in soils. John Wiley, New York, pp 449.
- Mengel, K. and Kirkby, E. A 1987. Principles of Plant Nutrition. International Potash Institute, Switzerland, pp 687.
- Mortvedt, J. Shuman, L. M., Cox, F. R. and Weich, R. M. (ed) 1991. Micronutrients in Agriculture. Soil Science Society of America, pp 760.
- Prasad, R. and Powar, J. F. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Lewis, Boca Ratoon, USA, pp356.
- Singh, Dhyan, Chhonkar, P. K. and Pandey, R. N. 1999. Soil Plant water analysis. A method manual. Indian agricultural research Institute, New Delhi, pp.160.
- Tisdale, S. L. Nelson, W. L., Beaton, J. D. and Havlin, J. L. 1990. Soil fertility and fertilizers (5th ed). Macmillan Pub. New York, pp754.
- Wild, A. (ed) Soil conditions and plant growth (11th ed) Longman, London, pp. 991.

Course Code:
SES-714

Course Title:
Soil Taxonomy

Credit Hrs:
3 (2+1)

Lecture Schedule:

Theory

•	Soil survey.	1
•	Concept of Soil Survey.	1
•	Objectives and methods of soil survey.	1
•	Soil mapping units.	1
•	Soil maps.	1
•	Land capability classification.	1
•	Productivity rating.	1
•	Cartography.	1
•	Soil survey reports for land use planning.	1
•	Land use planning and land use maps.	1
•	Waste land mapping.	1
•	Waste land classification.	1
•	Principal of soil classification.	1
•	Historical developments of soil classification.	1
•	Modern soil classification systems.	1
•	Importance of modern soil classification.	1
•	Mid - Semester Examination	
•	Soil orders Entisols.	1
•	Vertisols.	1
•	Inceptisols.	1
•	Aridisols.	1
•	Mollisols.	1
•	Spodosols.	1
•	Alfisol.	1
•	Ultisols.	1
•	Oxisols.	1
•	Histosols.	1
•	Soil taxonomy.	1
•	Scope and importance of soil grouping.	1
•	Pedons, Epidons, Polypedons.	1
•	Classification of soils.	1
•	Remote sensing.	1
•	Application of GIS.	1
•	Cartography with special reference to soil survey.	1
•	Total Numbers of Period	34

Practical:

•	Study of soil profile in selected areas.	2
•	Preparation of soil survey maps.	2
•	Soil profile and nomenclature of horizons.	2
•	Mottlings in sub soil horizons.	1
•	Soil color description and utility.	1

•	Soil pedons for classifications.	1
•	Visit to cartographic units.	2
•	Visual interpretation of imaginaries of soil and land use.	2
•	Preparation of land use maps.	1
•	Land capability classification.	1
•	Fertility capability classification.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

Boul, S. W., F. D. Kole and R. J. McCracken. 1975. Soil Genesis and classification. Oxford and IBH Pub. Co., New Delhi.

Yong, R. N. 1983. Geological environment and Soil Properties. American Society of Civil Engineers, New York.

Widing, L. P., N. E. Smeck, and G. F. Hall. 1983. Pedogenesis and soil taxonomy. Elsevier Publishers, New York.

Charles, W and Frinkle, Jr. 1982. Soil Classification. Murohinson Ross Publishing Co., Stroudsburg, Pennsylvania.

Soil survey staff, 1955. Soil Taxonomy- A Basic system of soil classification for making survey and interpretation. USDA handbook No. 463. Soil conservation service, USDA, Washington, D. C.

Course Code:
SES – 714

Course Title:
Statistics–2nd
(Design of Experiment and analysis of variance)

Credit Hrs:
3 (2+1)

Lecture Schedule:

Theory

•	Analysis of variance.	3
•	Definition and assumptions.	2
•	One way classification.	3
•	Two way classifications.	3
•	Sampling techniques.	2
•	Random sampling.	2
•	Stratified random Sampling.	2
•	Mid - Semester Examination	
•	Systematic sampling.	2
•	Design Experiments.	3
•	Randomized block design.	2
•	Latin square design.	2
•	Factorial designs.	2
•	Some p x q factorial experiments.	2
•	Split plot experiments.	2
•	Balanced incomplete block design.	2
•	Total Numbers of Period	34

Practical:

•	Analysis variance.	1
•	Randomized block design.	1
•	One way classification	2
•	Two way classifications.	2
•	Sampling techniques.	1
•	Random sampling.	1
•	Stratified random Sampling.	1
•	Systematic sampling.	1
•	Design Experiments.	1
•	Randomized block design.	1
•	Latin square design.	1
•	Factorial designs.	1
•	Some p x q factorial experiments.	1
•	Split plot experiments.	1
•	Balanced incomplete block design.	1
•	Total Numbers of Period	17

Reference Books:

Bernard Ostle and R.W. Mensing, Statistics in Research.

C.H. Goulden, Method of Statistical Analysis.

G.W. Snedecor and W.G. Cochran, Statistical Methods.

R.G. Steel and J.H. Torrie, Principles and Procedures of Statistics (with special reference to Biological Sciences)

R. Rangaswamy., A Text Book of Agricultural Statistics.
Chandel S.R.S, A Text Book of Agricultural Statistics.
W.G. Cochran and G.M.Cox, Experimental Designs.

Course Code:
SES – 780

Course Title:
Seminar - 1st

Credit Hrs:
1

Note: Seminar related to subject topics

Course Code:

SES-712

Course Title:

Geo- Chemistry

Credit Hrs:

3 (2+1)

Lecture Schedule:

Theory

•	Geo-chemistry, definition and scope.	1
•	Geological time scale.	1
•	Weathering definition and types.	1
•	Weathering of rocks.	1
•	Weathering of minerals.	1
•	Environment of weathering.	1
•	Interior of the earth.	1
•	Structure of the earth.	1
•	Materials of the earth crust.	1
•	Silicate and its classification.	1
•	Structure of silicate.	1
•	Structure of clay minerals.	1
•	Properties of silicate and clay minerals.	1
•	Hydrolysis of silicates.	1
•	Charges of Silicate clay.	1
•	Clays and its classification.	1
•	Mid - Semester Examination	
•	Charges developed of clays.	1
•	Charges development on mineral, clay lattice, mineral formation.	1
•	Phase rule.	1
•	Minerals formation in Unary system.	1
•	In two component Nepheline - Tridymite system.	1
•	In two component Nepheline - Quartz system.	1
•	In binary system Albite.	1
•	In binary system Anorthite.	1
•	Solid solution.	1
•	Colloids.	1
•	Physical properties of minerals.	1
•	Chemistry of Aluminium.	1
•	Chemistry of Iron and chemistry rock phosphate.	1
•	Application of geochemistry in agriculture.	1
•	Application of geochemistry in human health.	1
•	Mineral deposits (Epigenetic and syngenetic).	1
•	Supergene enrichment of ore deposit.	1
•	Total Numbers of Period	34

Practical:

•	Study of petrological microscope and its different parts	2
•	Identification of different rocks	2
•	Identification of different minerals	2

•	Identification of different ores	2
•	Identification of Quartz	1
•	Identification of Biotite	1
•	Identification of Muscovite	1
•	Identification of Albite	1
•	Identification Labradorite	1
•	Identification of microcline	1
•	Identification of Iron oxide etc. Under petrological microscope	2
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

Read, H. H. 1974. Rutleys elements of mineralogy 26th ed. George Allen and Unwin Limited, museum street London, W. C. L. pp. 560

Berry, L. G., Mason, B. Dietrich, R. V. Mineralogy (concepts, description and determination), CBS pub. And distributor , Delhi 110032.

Brownlow, A. H., 1979. Geochemistry, pp.498. Printice Hall.

Kraskopf, K. B., 1979. Itroduction to Geochemistry, 2nded. Pp. 617, McGraw Hill Book Corporation, New York.

Clark, S. P. 1971. Structure of the Earth, pp. 132, Printice Hall.

Ringwood, A. E. 1975. Composition and petrology of the Earth, Maltle pp. 618, McGraw- Hill Book Co., New York.

Bear, F. E. (ed) Chemistry of the soil (2nd) pp.515, Reinhold Pub. Corp., New York.

Grim, R. E., 1968. Clay mineralogy, 2nded. McGraw Hill Publicator, New York.

Course Code:

SES - 818

Course Title:

Soil fertility and fertilizers

Credit Hrs:

3 (2+1)

Lecture Schedule:**Theory**

•	Soil fertility and concept of soil fertility, Factors affecting soil fertility.	1
•	Soil productivity and soil fertility with their management practices.	1
•	Soil fertility management for sustainable agriculture.	1
•	Concepts soil fertility evaluation and estimation methods soil fertility.	1
•	Nutrient potential, Phosphate potential.	1
•	Lime and Gypsum requirement.	1
•	Fertilizer materials – compounds, mixed and high analysis fertilizers.	1
•	Methods of fertilizers application.	1
•	Efficient recovery of fertilizers nutrients.	1
•	World production and consumption of fertilizers, economics of fertilizers use.	1
•	Fertilizer use efficiency and factor affecting fertilizer use efficiency.	1
•	Long term effects of manures and fertilizers on soil productivity.	1
•	Integrated nutrient supply and management for sustainable agriculture.	1
•	Nutrient mobility concept in soils and crops.	1
•	Flow of nutrient during plant growth, growth functions.	1
•	Available nutrients, deficiency and toxicity, corrective measures.	1
•	Mid - Semester Examination	
•	Chemical and biological ratings and interpretation.	1
•	Chemistry and technology of NPK fertilizers.	1
•	Technology of NPK fertilizers.	1
•	Soil nitrogen- transformation of nitrogen in soils, nitrogenous fertilizers, crop response to nitrogenous fertilizers.	1
•	Soil phosphorous- transformation of phosphorous in soils, phosphatic fertilizers, residual effect of P availability, crop response to P fertilizers.	1
•	Soil potassium –dynamics of soil potassium, potassic fertilizers, crop response to K fertilizers.	1
•	Secondary and micronutrient elements and their fertilizers.	1
•	Reaction of fertilizers in soil and crop.	1
•	Soil and crop response multinutrient fertilizers.	1
•	Bio- fertilizers and uses of bio- fertilizers.	1
•	Organic manures, Organic matter removal constraints, role of organic manures in soil fertility.	1
•	Production system in developing countries.	1
•	Recycling of organic waste, quality of irrigation water.	1
•	Soil testing objectives, soil test crop response studies.	1
•	Approaches for fertilizers recommendations to crops.	1
•	Fertilizer recommendation for targeted yield.	1
•	Fertility management of problematic soils (saline, alkali, acid and calcareous soils, nutrient toxic soils).	1
•	Total Numbers of Period	34

Practical:

•	Organic carbon estimation.	1
---	----------------------------	---

•	Estimation of available N in soil.	1
•	Estimation of available P in soil.	1
•	Estimation of available K in soil.	1
•	Calculation of N, P and K requirement.	1
•	Estimation of S and Zn in soil.	1
•	Estimation of Fe and Mn in soil.	1
•	Estimation of Cu and B in soil.	1
•	Qualitative and quantitative estimation of soil nutrients.	1
•	Fertilizer nutrient recovery, Fertilizer analysis and quality control.	1
•	Determination moisture, nitrogen, phosphorus and potassium in fertilizers.	1
•	Analysis of compost for C: N ratio.	1
•	Analysis of compost for C: P ratio.	1
•	Analysis of compost for C: S ratio.	1
•	Estimation of pH and EC in irrigation water.	1
•	Estimation of TSS in irrigation water.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

- Tisdale, S. L., W. L. Nelson, J. D. Beaton and J. L. Havlin. 1995. Soil fertility and fertilizers 5th ed. Macmillan Publishing Co., New York.
- Black, C. a. 1993. Soil fertility evaluation and control, Lewis pub. London.
- Mengel, K. and E. A. Kirkby. 1987. Principles of plant nutrition. 4th ed. IPI Switzerland.
- Wild, A. 1988. Soil Condition and plant growth. 11thed, ELBS, London.
- Kanwar, J. S. 1976. Soil Fertility – Theory and practice ICAR pub, New Delhi.
- Biswas, T. D. and S. K. Mukherjee, 1992. Text book soil fertility. Tata Mc. Grew Hill, Publishing Co., New Delhi.

Course Code:

SES-821

Course Title:

Environmental Pollution

Credit Hrs:

3(2+1)

Lecture Schedule:

Theory

•	Environmental pollution definition, problems and hazards.	1
•	Nature and sources of pollutants.	1
•	Industrial, agricultural and municipal waste.	1
•	Pollution through Fertilizers, pesticides, radionucleotides.	1
•	Fossil fuels, oil spills etc.	1
•	Acid rain and its effect on the environment	1
•	Soil sickness due to biological agents and toxins etc.	1
•	Heavy metals toxicity.	1
•	Effects on nutrient availability and plant growth.	1
•	Characterization and monitoring of pollutants.	1
•	Air pollution as related to soil nature of pollutants.	1
•	Water pollution as related to soil nature of pollutants.	1
•	Sources and effect on plant growth.	1
•	Control measures of different pollutions.	1
•	Soil as sink for waste disposal.	1
•	Remediation of contaminated soil.	1
•	Mid - Semester Examination	
•	Remediation of contaminated water.	1
•	Environment concepts, monitoring and management of ecosystem.	1
•	Different types of pollution –	1
•	Air pollution- Sources, Effects and control measures	1
•	Water pollution- Sources, Effects and control measures	1
•	Soil pollution- Sources, Effects and control measures	1
•	Measurement tools and management of area specific problems.	1
•	Study of types, sources and effect of environmental pollution their control measurements,	1
•	solid waste and their disposal,	1
•	Pollutants transfer between soil	1
•	Pollutants transfer between water	1
•	Pollutants transfer between air,	1
•	Pesticides, herbicides ,	1
•	organophosphates detergents persistence their contamination,	1
•	environmental applications and management,	1
•	water pollution and monitoring,	1
•	WHO standards.	1
•	Total Numbers of Period	34

Practical:

•	Sampling of industrial effluents.	1
•	Sampling of industrial municipal waste water.	1
•	Estimation of dissolved and suspended solids in water sample.	1
•	Determination of chemical oxygen demand in water sample.	1
•	Determination of biological oxygen demand in water sample.	1
•	Determination of nitrate in water sample.	1
•	Determination of ammoniacal nitrogen in water sample.	1
•	Estimation of phosphorus in water sample.	1
•	Heavy metal analysis of contaminated soil.	1
•	Heavy metal analysis of contaminated water.	1
•	Air sampling and determination of particulate matter and oxides of sulphur	1
•	Determination of contaminants in soil.	1
•	Water and municipal waste water.	1
•	Estimation of dissolved and suspended solids.	1
•	Estimation of heavy metals in soil water and sewage samples.	1
•	Analysis and formulation of important insecticides and fungicides.	1
•	Final practical Examination	1
•	Total Numbers of Period	17

Reference Books:

- Middlebrooks, E. J. 1971. Industrial Pollution control Vol. 1. Agro- Industries. John Wiley Interscience, New York.
- Ross, S. M. 1994. Toxic Metals in soil plant system. John Wiley and Sons Chichester, U. K.
- Vesilund, P. A. and Pierce, J. J. 1983. Environmental Pollution and Control. Ann Arbor Science Pub. In. Mi. USA.

Course Code:

SES – 781

Course Title:Seminar - 2nd**Credit Hrs:**

1

Note: Seminar related to subject topics**Course Code:**

SES - 899

Course Title:

Dissertation / Thesis

Credit Hrs:

15

Note: Thesis related to subject topics