**Integral University, Lucknow**
**Integral Institute of Agricultural Science and Technology**
**Evaluation Scheme of Post Graduate Program**
**w.e.f. 2022-23**

## M. Sc. (Ag.) Soil Science

### Semester-II

| Course Code | Course Title | Type of Course | Periods/ Per week | | | Evaluation Scheme Theory Mid Sem | | | Evaluation Scheme Practical Mid Sem | | | Practical End Sem Exam | Sub Total (Theory + Practical Mid Sem Exam) | End Sem Theory Exam | Subject Total | Credit | Total Credit Points | Attributes | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CT | TA | Total | CT | TA | Total | | | | | | | Employability | Entrepreneurship | Skill Development | Gender Equality | Environment & Sustainability | Human Value | Professional Ethics |
| **SOIL 503** | **Soil Chemistry** | **Major** | 2 | 0 | 2 | 20 | 10 | **30** | - | - | - | 20 | **50** | **50** | **100** | 2:0:1 | 3 | √ | | √ | | | √ | √ |
| **SOIL 504** | **Soil Mineralogy, Genesis and Classification** | | 2 | 0 | 2 | 20 | 10 | **30** | - | - | - | 20 | **50** | **50** | **100** | 2:0:1 | 3 | √ | | √ | | √ | √ | √ |
| **Total** | | | | | | | | | | | | | | | | | | | | | | | | |
| **SOIL 506** | **Soil Biology and Biochemistry** | **Optional** | 2 | 0 | 2 | 20 | 10 | **30** | - | - | - | 20 | **50** | **50** | **100** | 2:0:1 | 3 | √ | √ | √ | | √ | | |
| **Total** | | | | | | | | | | | | | | | | | * | | | | | | | |
| ***Major Course (Core course + Optional course) should not exceed more than 9 credit** | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| **AGRON 504** | **Principles and Practices of Water Management** | **Minor** | 2 | 0 | 0 | 20 | 10 | **30** | - | - | - | - | **30** | **70** | **100** | 2:0:0 | 2 | √ | | √ | | √ | √ | √ |
| | | **Supporting** | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | | | | | ** | | | | | | | |
| **PGS502** | **Technical Writing and Communications Skills** | **Common** | 0 | 0 | 2 | 0 | 0 | **-** | - | - | - | 25 | **75** | **0** | **100** | 0:0:1 | 1 | √ | | √ | | | | √ |
| **PGS505 (e-Course)** | **Agricultural Research, Research Ethics and Rural Development Programmes** | | 1 | 0 | 0 | 20 | 10 | **30** | - | - | - | 0 | **0** | **70** | **100** | 1:0:0 | 1 | √ | | √ | | | √ | √ |
| **SOIL 591** | **Master's Seminar** | | - | - | - | - | - | - | - | - | - | - | - | - | **100** | 0:0:1 | 1 | | | √ | | | | |
| **SOIL 599** | **Master's Research** | | - | - | - | - | - | - | - | - | - | - | - | - | S/US | 0:0:5 | 5[$] | √ | | √ | | | √ | √ |
| **Grand Total** | | | | | | | | | | | | | | | | | *** | | | | | | | |

*Grand Total (***) = *+**, credit should not exceed more than 22 credit in one semester; [$]Master's Research credit to be counted in Final Semester examinations; S/US=Satisfactory/Unsatisfactory*

**M. Sc. (Ag.) Soil Science**
**SEMESTER-II**
**Course Title: Soil Chemistry**
**Course Code: SOIL 503**
**w.e.f. Session 2022-23**

**3(2+1)**

**Unit-I**
Chemical (elemental) composition of the earth's crust, soils, rocks and minerals. 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, Characterization of OM; clay-organic interactions.

**Unit-III**
Ion exchange processes in soil; cation exchange- theories based on law of massaction (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– inner sphere and outer-sphere surface complex formation, fixation of oxy anions, 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; Concept of quantity/intensity (Q/I) relationship; step and constant-rate K; management aspects. 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, ECe, ESP, SAR and important relations; soil management and amendments. Chemistry and electrochemistry of submerged soils, geochemistry of micronutrients, environmental soil chemistry

**Practical:**
Preparation of saturation extract, measurement of pH, EC, CO, HCO, Ca, Mg, K and Na; Determination of CEC and AEC of soils; Analysis of equilibrium soil solution for pH, EC, Eh by the use of Eh-pH meter and conductivity meter; Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method; Extraction of humic substances; Potentiometric and conductometric titration of soil humic and fulvic acids; (E4/E6) ratio of soil humic and fulvic acids by visible spectrophotometric studies and the D (E4/E6) 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 Q/I relationship of potassium; 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 and Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.
- Greenland DJ and Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.
- Greenland DJ and Hayes MHB. Chemistry of Soil Constituents. John Wiley & Sons.
- McBride MB. 1994. Environmental Chemistry of Soils. Oxford University Press.
- Sposito G. 1981. The Thermodynamics of Soil Solutions. Oxford University Press.

- Sposito G. 1984. The Surface Chemistry of Soils. Oxford University Press.
- Sposito G. 1989. The Chemistry of Soils. Oxford University Press.
- Stevenson FJ. 1994. Humus Chemistry. 2nd Ed. John Wiley & Sons.
- Van Olphan H. 1977. Introduction to Clay Colloid Chemistry. John Wiley & Sons.


**COURSE OBJECTIVES:**

- To study earth's elemental composition and basics of physical chemistry
- To learn properties of soil colloids
- Knowledge of soil organic matter
- To study ion exchange processes in soil
- To know chemistry of NPK in soil
- To know chemistry of problematic soils

**COURSE OUTCOMES (CO):**

***After completion of the course, a student will be able to***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | Knowledge about earth's elemental composition and physical chemistry |
| **CO2** | Understand the properties of inorganic and organic soil colloids |
| **CO3** | Understand the ion exchange processes in soil |
| **CO4** | Knowledge of sorption-desorption mechanisms and NPK chemistry in soil |
| **CO5** | Understand the chemistry of problematic soils |

**CO-PO-PSO MAPPING:**

| | PO | | | | | | | | | | PSO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 |
| **CO2** | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 |
| **CO4** | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 3 |
| **CO5** | 2 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 3 |
| 3: Strong contribution, 2: average contribution, 1: Low contribution | | | | | | | | | | | | | | |

**M. Sc. (Ag.) Soil Science**
**SEMESTER-II**
**Course Title: Soil Mineralogy, Genesis and Classification**
**Course Code: SOIL 504**
**w.e.f. Session 2022-23**

**3(2+1)**

**Unit-I**
Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism.

**Unit-II**
Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystal line and non-crystal line clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate minerals and their identification; clay minerals in Indian soils, role of clay minerals in plant nutrition, interaction of clay with humus, pesticides and heavy metals.

**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 soil maps – usefulness.

**Practical:**
Separation of sand, silt and clay fraction from soil; Determination of specific surface area and CEC of clay; Identification and quantification of minerals in soil fractions; Morphological properties of soil profile in different land forms; Classification of soils using soil taxonomy; Calculation of weathering indices and its application in soil formation; Grouping soils using available database in terms of soil quality.

**Suggested Readings:**

- Brady NC and Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
- Buol EW, Hole ED, MacCracken RJ and 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.
- Wilding LP and Smeck NE. 1983. Pedogenesis and Soil Taxonomy: II. The Soil Orders. Elsevier.
- Wilding NE and Holl GF. (Eds.). 1983. Pedogenesis and Soil Taxonomy. I.

**COURSE OBJECTIVES:**

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

**COURSE OUTCOME (CO):**

***After completion of the course, a student will be able to***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | Students will be able to know of basic structure of alumino-silicate minerals |
| **CO2** | Students will have the knowledge of genesis of clay minerals; soil genesis in terms of factors and processes of soil formation. |
| **CO3** | Students can conduct soil survey and interpret soil survey reports, |
| **CO4** | Students will have the idea of different soil classification systems |

**CO-PO-PSO MAPPING**

| | PO | | | | | | | | | | PSO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| **CO3** | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| 3: Strong contribution, 2: average contribution, 1: Low contribution | | | | | | | | | | | | | | |

**M. Sc. (Ag.) Soil Science**
**SEMESTER-II**
**Course Title: Soil Biology and Biochemistry**
**Course Code: SOIL 506**
**w.e.f. Session 2022-23**

**3(2+1)**

**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; Root rhizosphere and PGPR.

**Unit-III**
Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, microbiology and biochemistry of decomposition of carbonaceous and protenaceous materials, cycles of important organic nutrients.

**Unit-IV**
Organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil. 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; FCO specifications and quality control of biofertilizers.

**Unit-V**
Biological indicators of soil quality; bioremediation of contaminated soils; microbial transformations of heavy metals in soil; role of soil organisms inpedogenesis – important mechanisms and controlling factors; soil genomics and bioprospecting; soil sickness due to biological agents; xenobiotics; antibiotic production in soil.

**Practical:**
Determination of soil microbial population; Soil microbial biomass carbon; 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, $N_2$ fixation, S oxidation, P solubilization and mineralization of other micronutrients.

**Suggested Readings:**

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


**COURSE OBJECTIVES:**
- To learn about the soil biology
- To provide knowledge various methods of enzymatic activities in soil
- To know the essential micro nutrients
- To learn about soil biochemistry
- To study about biofertilizers

**COURSE OUTCOMES (CO):**

***After completion of the course, a student will be able to***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | To learn about the soil biology |
| **CO2** | To provide knowledge various methods of enzymatic activities in soil |
| **CO3** | To know the essential micro nutrients |
| **CO4** | To learn about soil biochemistry |
| **CO5** | To study about bio fertilizers |

**CO-PO-PSO MAPPING:**

| | PO | | | | | | | | | | PSO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 1 |
| **CO5** | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| 3: Strong contribution, 2: average contribution, 1: Low contribution | | | | | | | | | | | | | | |

**M.Sc. (Ag.) Agronomy**
**SEMESTER-II**
**Course Title: Principles and Practices of Water Management**
**Course Code: AGRON 504**
**w.e.f. Session 2022-23**

**3(2+1)**

**Unit-I**
Water and its role in plants; Irrigation: Definition and objectives, water resources and irrigation development in of India and concerned state, major irrigation projects, extent of area and crops irrigated in India and in different states.

**Unit-II**
Field water cycle, 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. Water availability and its relationship with nutrient availability and loses.

**Unit-III**
Soil, plant and meteorological factors determining water needs of crops, scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and polyhouses. Irrigation efficiency and water use efficiency.

**Unit-IV**
Water management of crop and cropping system, Quality of irrigation water and management of saline water for irrigation, water use efficiency, Crop water requirement- estimation of ET and effective rainfall; Water management of the major crops and cropping systems. Automated irrigation system.

**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; rain water management and its utilization for crop production.

**Unit-VI**
Quality of irrigation water and management of saline water for irrigation, water management in problem soils. Soil moisture conservation, water harvesting, rain water management and its utilization for crop production. Hydroponics. Water management of crops under climate change scenario.

**Practical:**
Determination of Field capacity by field method; Determination of Permanent Wilting Point by sunflower pot culture technique; Determination of Field capacity and Permanent Wilting Point by Pressure Plate Apparatus; Determination of Hygroscopic Coefficient; Determination of maximum water holding capacity of soil; Measurement of matric potential using gauge and mercury type tensiometer; Determination of soil-moisture characteristics curves, Determination of saturated hydraulic conductivity by constant and falling head method; Determination of hydraulic conductivity of saturated soil below the water table by auger hole method; Measurement of soil water diffusivity; Estimation of unsaturated hydraulic conductivity; Estimation of upward flux of water using tensiometer and from depth ground water table; Determination of irrigation requirement of crops (calculations); Determination of effective rainfall (calculations); Determination of ET of crops by soil moisture depletion method; Determination of water requirements of crops; Measurement of irrigation water by volume and velocity-area method; Measurement of irrigation water by measuring devices and calculation of irrigation efficiency; Determination of infiltration rate by double ring infiltrometer.

**Suggested Readings:**

- Majumdar DK. 2014. Irrigation Water Management: Principles and Practice. PHL Learning Private Publishers
- Mukund Joshi. 2013. A Text Book of Irrigation and Water Management Hardcover, Kalyani Publishers
- 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 and Sandhu BS. 1987. Irrigation of Food Crops - Principles and Practices. ICAR.
- Reddy SR. 2000. Principles of Crop Production. Kalyani.
- Singh Pratap and Maliwal PL. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.


**COURSE OBJECTIVES:**

- To teach the students about water resources available for agriculture
- To teach the students about principles of water management practices
- To study the quality of irrigation water in relation to crop requirement
- Best management strategies as per nature and demand of crops for water
- Maximization of water use efficiency.

**COURSE OUTCOMES (CO):**

***After completion of the course, a student will be able to***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | Students will be able to describe the water resources availability in agriculture |
| **CO2** | Students know about principles of water management practices |
| **CO3** | Efficient irrigation management in crop production |
| **CO4** | Higher water use efficiency as per crop |
| **CO5** | Reduction in water losses in crop cultivation |

**CO-PO-PSO MAPPING:**

| | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO4** | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 |
| 3: Strong contribution, 2: average contribution, 1: Low contribution | | | | | | | | | | | | | | | |

**M. Sc. (Ag.)/M.Sc. (Hort.)/MBA Agribusiness Management**
**SEMESTER-II**
**Course Title: Technical Writing and Communications Skills**
**Course Code: PGS 502**
**w.e.f. Session 2018-19**

**1(1+0)**

**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; pagination, 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); 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**


- Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.
- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
- Mohan K. 2005. Speaking English Effectively. MacMillan India.
- Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
- Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
- Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
- Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
- Collins' Cobuild English Dictionary. 1995. Harper Collins.
- James HS. 1994. Handbook for Technical Writing. NTC Business Books.
- Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.
- Richard WS. 1969. Technical Writing. Barnes & Noble.


**COURSE OBJECTIVES:**

- To give knowledge about the various forms of scientific writings
- To give knowledge about the various parts of thesis, research communications
- To give knowledge about writing of abstracts, summaries, citations etc
- To give knowledge about research communications, illustrations, photograph, drawings
- To give knowledge about pagination, scientific write ups, editing and proof reading, and writing of review article

**COURSE OUTCOMES (CO):**

***After completion of the course, a student will be able to***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | Learn that what are the various forms of scientific writings |
| **CO2** | Learn how to write the various parts of thesis, research communications |
| **CO3** | Learn how to do writing of abstracts, summaries and what are citations etc |
| **CO4** | Learn research communications, illustrations, photograph, drawings |

| | |
|---|---|
| **CO5** | Learn pagination, scientific write ups, editing and proof reading, and writing of review article |

**CO-PO-PSO MAPPING:**

| | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 1 | 2 | 0 | 0 | 2 | 0 | 1 | 1 | 3 | 3 | 2 | 2 | 1 |
| **CO2** | 3 | 3 | 1 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 2 |
| **CO3** | 3 | 3 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 3 | 3 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | 3 | 0 | 2 | 2 | 0 | 0 | 0 | 3 | 3 | 2 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 0 | 3 | 2 | 1 | 0 | 0 | 3 | 3 | 2 | 2 | 1 |
| 3: Strong contribution, 2: average contribution, 1: Low contribution | | | | | | | | | | | | | | | |

**M. Sc. (Ag.)/M.Sc. (Hort.)/MBA Agribusiness Management**
**SEMESTER-II**
**Course Title: Agricultural Research, Research Ethics and Rural Development Programmes**
**Course Code: PGS505 (e-Course)**
**w.e.f. Session 2018-19**

**1(0+1)**

**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; 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-II**

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

**Unit-III**

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, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations. 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 Publ.


**COURSE OBJECTIVES:**

- To know the objective and principle of extension education
- To obtain idea on various development programmes in agriculture and allied area to help farmers.
- 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.

**COURSE OUTCOMES (CO):**

***After completion of the course, a student will be able to***

| COURSE OUTCOME (CO) | DESCRIPTION |
|---|---|
| **CO1** | Students capable, efficient, and self-reliant in character. |
| **CO2** | They gain knowledge to help rural families in better appreciation of SWOT in the village. |
| **CO3** | They know about to open new opportunities for developing talents and leadership of rural people. |
| **CO4** | To provide knowledge and help for better management of farms and increase incomes. |

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|---|---|
| **CO5** | To promote better social, natural recreational intellectual and spiritual file among the people. |

**CO-PO-PSO MAPPING:**

| | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO3** | 3 | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 2 |
| **CO4** | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 |
| **CO5** | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| 3: Strong contribution, 2: average contribution, 1: Low contribution | | | | | | | | | | | | | | | |