Course Title with Credit Load
M.Sc. in Soil Science

Course Code	Course Title	Credit Hours
*Soil 501	Soil physics	(2+1)
*Soil 502	Soil fertility and fertilizer use	(2+1)
*Soil 503	Soil chemistry	(2+1)
*Soil 504	Soil mineralogy, genesis and classification	(2+1)
Soil 505	Soil erosion and conservation	(2+1)
Soil 506	Soil Biology and Biochemistry	(2+1)
Soil 507	Radioisotopes in soil and plant studies	(1+1)
Soil 508	Soil, water and air pollution	(2+1)
Soil 509	Remote sensing and GIS technique for soil and crop studies	(2+1)
Soil 510	Analytical technique and instrumental methods in soil and plant analysis	(0+2)
Soil 511	Management of problematic soils and water	(1+1)
Soil 512	Land degradation and restoration	(1+0)
Soil 513	Soil Survey and Land use Planning	(2+0)
Soil 514	Introduction to nanotechnology	(2+1)
Soil 591	Master's Seminar	(1+0)
Soil 599	Master's Research	-30

*Indicates Core Courses which are Compulsory for Master Programme

Course Curriculum of PG Programme

(Major, Minor, Supporting and Non-credit courses)

MASTER OF SCIENCE IN SOIL SCIENCE

SEMESTER-I

SHRI VAISHNAV INSTITUTE OF AGRICULTURE, INDORE

SHRI VAISHNAV VIDYAPEETH

VISHWAVIDYALAYA, INDORE

SYLLABUS

MASTER OF SCIENCE IN SOIL SCIENCE

SEMESTER-I

COURSE CODE	COURSE TITLE	CREDITS
MAJOR		
Soil 503	Soil Chemistry	2+1
Soil 504	Soil Mineralogy, Genesis, Classification	2+1
Soil 506	Soil Biology and Biochemistry	2+1
MINOR		
Agron 504	Principles and Practices of Water Management	2+1
Agron 513	Principles and Practices of Organic Farming	2+1
SUPPORTING		
STAT 511	Experimental Designs	2+1
NON-CREDIT		
PGS 501	Library and Information Services	0+1
PGS 502	Technical Writing and Communications Skills	0+1
PGS 503	Intellectual Property and its Management in Agriculture	1+0

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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
Soil 503	Soil Chemistry	50	30	00	15	05	2	1	3

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

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

Objectives-

- 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.

Course Outcome

- Describe the chemical (elemental) composition of the earth's crust and various chemical processes involved in soil.
- Understand the ion exchange processes in soil, cation exchange- theories based on law of mass action.
- Describe the chemistry of salt-affected soils and amendments and chemistry and electrochemistry of submerged soils.

UNIT I

Chemical (elemental) composition of the earth's crust, soils, rocks and minerals.

UNIT II

Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics.

UNIT III

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 IV

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 – inner sphere 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 V

Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation-dissolution equilibria; 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.

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 BaCl2-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.

Teaching methods/activities

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

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*. 2nd Ed. John Wiley & Sons.
- Van Olphan H. 1977. *Introduction to Clay Colloid Chemistry*. John Wiley & Sons.

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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
Soil 504	Soil Mineralogy, Genesis, Classification and Survey	50	30	00	15	05	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

- To acquaint students with basic structure of alumino-silicate minerals and genesis of clay minerals; soil genesis interms 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.

Outcomes

- Describe the identification techniques, amorphous soil constituents and other non-crystalline silicate minerals
- Understand the factors of soil formation, soil formation models and soil forming processes.
- Describe the soil survey and its types, soil survey techniques - conventional and modern

Theory

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 crystalline and non-crystalline clay minerals;

UNIT III

Identification techniques; amorphous soil constituents and other on-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 IV

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 V

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 soil susing available database in terms of soil quality

Teaching methods/activities

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

Suggested Readings

- Brady NC & 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 & 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 & 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*.

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		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
Soil 506	Soil Biology and Biochemistry	50	30	00	15	05	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

- 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.

Course outcome

- Students will learn about the soil biota, soil microbial ecology, types of organisms in different soils and soil microbial biomass.
- Students will know how the microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil takes place.
- Students will be able to understand the biodegradation of pesticides, organic wastes and their use for production of biogas and manures

Theory

UNIT I

Soil biota, soil microbialecology, 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.

UNIT V

Biofertilizers–definition, classification, specifications, method of production and role in crop production; FCO specifications and quality control of biofertilizers. Biological indicators of soil quality; bioremediation of contaminated soils; microbial transformations of heavy metals in soil; role of soil organisms in pedogenesis – 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
- 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 fixation, S oxidation, P solubilization and mineralization of other micro nutrients.

Teaching methods/ activities

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

Learning outcome

Experience on the knowledge of soil microbes and their utility in research for solving field problem.

Suggested Reading

• 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.

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		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
Agron 504	Principles and Practices of Water Management	50	30	00	15	05	2	1	3

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

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

Course Outcome

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

Theory

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-waterplant 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. 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.

Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment and field visit

Learning outcome

Basic knowledge on water management for optimization of crop yield

Suggested Reading

• 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.

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		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
Agron 513	Principles and Practices of Organic Farming	50	30	00	15	05	2	1	3

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

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

Course Outcome

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; principles of organic agriculture; organics and farming standards; organic farming and sustainable agriculture; selection and conversion of land, soil and water management - land use, conservation 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, bio-fertilizers and biogas technology.

UNIT III

Farming systems, selection of crops andcrop 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, bio-pesticides.

UNIT V

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

Practical

• Method of making compost by aerobic method.
• Method of making compost by anaerobic method.
• Method of making vermicompost.
• Identification and nursery raising of important agro-forestry tress and tress 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 a biogas plant.
• Visit to an organic farm.
• Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms.

Teaching methods/activities

Classroom teaching with AV aids, group discussion, assignment. exposure visit

Learning outcome

Basic knowledge on organic farming for sustainable agriculture and development of entrepreneurship on organic inputs.

Suggested Reading

• 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. • Joshi M. 2016. New Vistas of Organic Farming. Scientific Publishers.

• Lampin N. 1990. Organic Farming. Press Books, lpswitch, UK.

• Palaniappan SP and 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, ParisaraprajnaParishtana, 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.

• Subba Rao NS. 2002. Soil Microbiology. Oxford & IBH.

• Trivedi RN. 1993. A Text Book of Environmental Sciences, Anmol Publ.

• Veeresh GK, Shivashankar K and 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 and Swift MJ. 1994. The Biological Management of Tropical Soil Fertility. TSBF & Wiley. Sharma A. 2002. *Hand Book of Organic Farming*. Agrobios.

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		THEORY			PRACTICAL		L	P	CREDITS
		End Sem University Exam	Mid Term Exam	Teachers Assessment*	End Sem University Exam	Teacher's Assessment*			
PGS 501	Library and Information Services	00	00	00	60	40	0	1	1

Legends: L - Lecture; **P** – Practical;
*Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class etc.

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 techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

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		THEORY			PRACTICAL		L	P	CREDITS
		End Sem University Exam	Mid Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*			
PGS 502	Technical Writing & Communications Skills	0	0	0	60	40	0	1	1

Legends: L - Lecture; **P** – Practical;
*Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class etc.

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

• 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

- Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
- Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
- Collins' Cobuild English Dictionary. 1995.
- Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed.

- Holt, Rinehart and 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. 5th Ed. Affiliated East-West Press.
- Mohan K. 2005. Speaking English Effectively. MacMillan India.
- Richard WS. 1969. Technical Writing.
- Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
- Wren PC and Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

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		THEORY			PRACTICAL		L	P	CREDITS
		End Sem University Exam	Mid Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*			
PGS 503	Intellectual Property and Its Management in Agriculture	50	40	10	0	0	1	0	1

Legends: L - Lecture; **P** – Practical;
*Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class etc.

Objectives

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

UNIT I
Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.

UNIT II
Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.

UNIT III
Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks etc.

UNIT IV
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;

UNIT V
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 F H & 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

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