

# Course Curriculum of PG Programme

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

## MASTER OF SCIENCE IN AGRONOMY SEMESTER-I



SHRI VAISHNAV INSTITUTE OF  
AGRICULTURE, INDORE  
SHRI VAISHNAV VIDYAPEETH  
VISHWAVIDYALAYA, INDORE



**SYLLABUS**  
**MASTER OF SCIENCE IN AGRONOMY**  
**SEMESTER-I**

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>
<b>MANOR</b>		
AGRON 501	Modern Concepts in Crop Production	3+0
AGRON 504	Principles And Practices of Water Management	2+1
AGRON 513	Principles And Practices of Organic Farming	2+1
<b>MINOR</b>		
SOILS 503	Soil Chemistry	2+1
SOILS 506	Soil Biology and Biochemistry	2+1
<b>SUPPORTING</b>		
STAT 511	Experimental Designs	2+1
<b>NON-CREDIT</b>		
PGS 501	Library and Information Services	0+1
PGS 502	Technical Writing and Communication Skills	0+1
PGS 503	Intellectual Property and its Management in Agriculture	1+0





**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Agriculture**  
**M.Sc. (Ag.) Agronomy**

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
<b>AGRON 501</b>	<b>Modern Concepts in Crop Production</b>	<b>50</b>	<b>40</b>	<b>10</b>	<b>00</b>	<b>00</b>	<b>3</b>	<b>0</b>	<b>3</b>

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

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

**Objective**

To teach the basic concepts of soil management and crop production.

**Theory**

**UNIT I**

Crop growth analysis in relation to environment; agro-ecological zones of India.

**UNIT II**

Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.

**UNIT III**

Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

**UNIT IV**

Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress.

**UNIT V**

Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture. Modern crop production concepts: soil less cultivation, Aeroponic, Hydroponic, Robotic and terrace farming. use of GIS, GPS and remote sensing in modern agriculture, precision farming and protected agriculture.

**Suggested Readings**

1. Balasubramanian P & Palaniappan SP. 2001. *Principles and Practices of Agronomy*. Agrobios.
2. Fageria NK. 1992. *Maximizing Crop Yields*. Marcel Dekker.
3. Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. 7<sup>th</sup> Ed. Prentice Hall.
4. Paroda R.S. 2003. *Sustaining our Food Security*. Konark Publ. Reddy SR. 2000. *Principles of Crop Production*. Kalyani Publ.

5. Reddy SR. 2000. *Principles of Crop Production*. Kalyani Publ.
6. Sankaran S & Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ.
7. Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
8. Alvin PT and kozlowski TT (ed.). 1976. *Ecophysiology of Tropical Crops*. Academia Pul., New York.
9. Gardner PP, Pearce GR and Mitchell RL. 1985. *Physiology of Crop Plants*. Scientific Pub. Jodhpur.
10. Lal R. 1989. *Conservation tillage for sustainable agriculture: Tropics versus Temperate Environments*. *Advances in Agronomy* 42: 85-197.
11. Wilsie CP. 1961. *Crop Adaptation and Distribution*. Euresia Pub., New Delhi

(Prof. Vinod Dhar)  
Chairperson - Board of Studies,  
SVVV, Indore

(Dr. K. N. Guruprasad)  
Dean-Faculty of Agriculture,  
SVVV, Indore

(Dr. Shishir Jain)  
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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.**

**Objective**

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. 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 II**

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. 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 III**

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.

**UNIT IV**

Soil moisture conservation, water harvesting, rainwater management and its utilization for crop production. Hydroponics.

**UNIT V**

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**

1. Majumdar DK. 2014. *Irrigation Water Management: Principles and Practice*. PHL Learning private publishers
2. Mukund Joshi. 2013. *A Text Book of Irrigation and Water Management* Hardcover, Kalyani publishers
3. Lenka D. 1999. *Irrigation and Drainage*. Kalyani
4. Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.
5. Paliwal KV. 1972. *Irrigation with Saline Water*. IARI Monograph, NewDelhi.
6. Panda SC. 2003. *Principles and Practices of Water Management*.
7. Agrobios.
8. Prihar SS & Sandhu BS. 1987. *Irrigation of Food Crops - Principles and Practices*. ICAR.
9. Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
10. Singh Pratap & Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publ.

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SVVV, Indore

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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.**

**Objective**

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

**Theory**

**UNIT I**

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; 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 and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

**UNIT IV**

Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.

**UNIT V**

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

**Practical**

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

**Suggested Readings**

1. Ananthakrishnan TN. (Ed.). 1992. *Emerging Trends in Biological Control of Phytophagous Insects*. Oxford & IBH.
2. Gaur AC. 1982. *A Manual of Rural Composting*, FAO/UNDP Regional Project Document, FAO.
3. Joshi M. 2016. *New Vistas of Organic Farming*. Scientific Publishers
4. Lampin N. 1990. *Organic Farming*. Press Books, Ipswich, UK.
5. Palaniappan SP & Anandurai K. 1999. *Organic Farming – Theory and Practice*. Scientific Publ.
6. Rao BV Venkata. 1995. *Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3*, Parisaraprajna Parishtana, Bangalore.
7. Reddy MV. (Ed.). 1995. *Soil Organisms and Litter Decomposition in the Tropics*. Oxford & IBH.
8. Sharma A. 2002. *Hand Book of Organic Farming*. Agrobios.
9. Singh SP. (Ed.) 1994. *Technology for Production of Natural Enemies*. PDDB, Bangalore.
10. Subba Rao NS. 2002. *Soil Microbiology*. Oxford & IBH.
11. Trivedi RN. 1993. *A Text Book of Environmental Sciences*, Anmol Publ.
12. Veeresh GK, Shivashankar K & Suiglachar MA. 1997. *Organic Farming and Sustainable Agriculture*. Association for Promotion of Organic Farming, Bangalore.
13. WHO. 1990. *Public Health Impact of Pesticides Used in Agriculture*. WHO.
14. Woolmer PL & Swift MJ. 1994. *The Biological Management of Tropical Soil Fertility*. TSBF & Wiley.

(Prof. Vinod Dhar)  
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SVVV, Indore

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SOILS 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.**

**Objective**

To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils in relation to using soils as a medium for plant growth.

**Theory**

**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 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 IV**

Potassium, phosphate and ammonium fixation in soils covering specific and nonspecific sorption; precipitation-dissolution equilibria; Concept of quantity/intensity(Q/ I)relationship; step and constant-rate K; management aspects

**UNIT V**

Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity. Chemistry of salt-affected soils and amendments; soil pH, E<sub>Ce</sub>, 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<sub>2</sub>-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

1. Bear RE. 1964. Chemistry of the Soil. Oxford and IBH.
2. Bolt GH and Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.
3. Greenland DJ and Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.
4. Greenland DJ and Hayes MHB. Chemistry of Soil Constituents. John Wiley & Sons.
5. McBride MB. 1994. Environmental Chemistry of Soils. Oxford University Press.
6. Sposito G. 1981. The Thermodynamics of Soil Solutions. Oxford University Press.
7. Sposito G. 1984. The Surface Chemistry of Soils. Oxford University Press.
1. Sposito G. 1989. The Chemistry of Soils. Oxford University Press.
2. Stevenson FJ. 1994. Humus Chemistry. 2nd Ed. John Wiley & Sons.
3. Van Olphan H. 1977. Introduction to Clay Colloid Chemistry. John Wiley & Sons.

(Prof. Vinod Dhar)  
Chairperson - Board of Studies,  
SVVV, Indore

(Dr. K. N. Guruprasad)  
Dean-Faculty of Agriculture,  
SVVV, Indore

(Dr. Shishir Jain)  
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(Dr. Arvind Singh)  
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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
<b>SOILS 506</b>	<b>Soil Biology and Biochemistry</b>	<b>50</b>	<b>30</b>	<b>00</b>	<b>15</b>	<b>05</b>	<b>2</b>	<b>1</b>	<b>3</b>

**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.

**Theory**

**UNIT I**

Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; un-culturable soil biota.

**UNIT II**

Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora.

**UNIT III**

Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation; cycles of important organic nutrients.

**UNIT IV**

Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil.

**UNIT V**

Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost. Biofertilizers – definition, classification, specifications, method of production and role in crop production.

**Practical**

- Determination of soil microbial population
- Soil microbial biomass
- Elemental composition, fractionation of organic matter and functional groups
- Decomposition of organic matter in soil
- Soil enzymes
- Measurement of important soil microbial processes such as ammonification, nitrification,

N<sub>2</sub> fixation, S oxidation, P solubilization and mineralization of other micro nutrients

- Study of rhizosphere effect

### **Suggested Readings**

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

(Prof. Vinod Dhar)  
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SVVV, Indore

(Dr. K. N. Guruprasad)  
Dean-Faculty of Agriculture,  
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PGS 501	Library and Information Services	00	00	00	60	40	0	1	1

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

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

**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.

**Suggested Readings**

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

(Prof. Vinod Dhar)  
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PGS 502	Technical Writing and Communication Skills	00	00	00	60	40	0	1	1

1. Legends: L - Lecture; P – Practical

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

### 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

1. Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
2. Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
3. Collins' Cobuild English Dictionary. 1995.
4. Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed.
5. Holt, Rinehart and Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
6. James HS. 1994. Handbook for Technical Writing. NTC Business Books.
7. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-

West Press.

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

9. Richard WS. 1969. Technical Writing.

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

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

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PGS 503	Intellectual Property and Its Management in Agriculture	00	00	00	60	40	1	0	1

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

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

**Objective**

The main objective of this course is to equip students and stakeholders with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge based economy.

**Theory**

**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, protection of plant varieties and farmers' rights and biodiversity protection

**Unit IV:**

Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity

**Unit V:**

International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

**Suggested Readings**

1. Erbis FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
2. Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
3. Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies.

4. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
  5. Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
  6. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
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(Prof. Vinod Dhar) Chairperson - Board of Studies, SVVV, Indore	(Dr. K. N. Guruprasad) Dean-Faculty of Agriculture, SVVV, Indore	(Dr. Shishir Jain) Controller of Examination, SVVV, Indore	(Dr. Arvind Singh) Registrar, SVVV, Indore
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