



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Agriculture
M.Sc. (Ag.) Entomology, I semester

Syllabus

ENT 501: Insect Morphology (2+1)

Course code	Course Name	TEACHING & EVALUATION SCHEME							
		THEORY			PRACTICAL		L	P	CREDITS
		END SEM University Exam	Mid Term Exam	Teachers Assessment*	END SEM University Exam	Teacher's Assessment*			
ENT 501	Insect Morphology	50	30	00	15	05	2	1	3

Legends: L - Lecture; P – Practical;

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

Aim of the course

To acquaint the students with the external morphology of the insect's body and the functioning of various body parts.

Theory

Unit I

External Morphology: Insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.

Head- Origin, structure and modification; mouthparts, antennae, their types and functioning; tentorium and neck sclerites.

Unit II

Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; legs: structure and modifications.

Abdomen- Segmentation and appendages, genitalia and their modifications; embryonic and post-embryonic development.



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Practical

- Preparation of permanent mounts of different body parts and their appendages of taxonomic importance including male and female genitalia;
- Dissection of genitalia. Types of immature stages in insects; their collection, rearing and preservation;
- Identification of immature insects to orders and families, in endopterygote orders, viz., Diptera, Lepidoptera, Hymenoptera and Coleoptera using key.

Suggested Readings

- Chapman RF. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
- Chu HF. 1992. How to Know Immature Insects. William Brown Publication, Iowa.
- Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publishers, New Delhi.
- Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi.
- Gillott C. 1995. Entomology, 2nd Ed. Plenum Press, New York, London.
- Gullan PJ and Cranston PS. 2000. The Insects, An Outline of Entomology, 2nd Ed. Blackwell Science, UK.
- Peterson A. 1962. Larvae of Insects. Ohio University Press, Ohio.
- Richards OW and Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman and Hall, London.
- Snodgrass RE. 1993. Principles of Insect Morphology. Cornell Univ. Press, Ithaca.
- Tembore DB. 2000. Modern Entomology, Himalaya Publishing House, Mumbai.
- Stehr FW. 1998. Immature Insects. Vols. I, II. Kendall Hunt Publication, Iowa.



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ENT- 504: Insect Ecology (2+1)

Course code	Course Name	TEACHING & EVALUATION SCHEME							
		THEORY			PRACTICAL		L	P	CREDITS
		END SEM University Exam	Mid Term Exam	Teachers Assessment*	END SEM University Exam	Teacher's Assessment*			
ENT 504	Insect Ecology	50	30	00	15	05	2	1	3

Legends: L - Lecture; P – Practical;

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

Aim of the course

To teach the concepts of ecology, basic principles of distribution and abundance of organisms and their causes. Study life tables, constructing life tables, organization of communities, diversity indices. Train students in sampling methodology, calculation of diversity indices, relating insect population fluctuations to biotic and/ or abiotic causes.

Theory

Unit I

History and definition. Basic Concepts. Organisation of the Biological world. Plato's Plant Protection-Entomology 173 Natural Balance vs Ecological Dynamics as the modern view. Abundance and diversity of insects, Estimates and Causal factors. Study of abundance and distribution and relation between the two. Basic principles of abiotic factors and their generalised action on insects.

Unit II

Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, and biocoenosis. Systems approach to ecology. Basic concepts of abundance- Model vs Real world. Population growth basic models – Exponential vs Logistic models. Discrete vs Continuous growth models. Concepts of Carrying capacity,



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Unit IV

Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions – The argument of cost-benefit ratios. Competition- Lotka-Volterra model, Concept of niche ecological homologues, competitive exclusion. Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies.

Unit V

Community ecology- Concept of guild, Organisation of communities- Hutchinson Ratio, May's d/w, Relation between the two and their association with Dyar's Law and Prizibram's law. Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity- stability debate, relevance to pest management. Pest management as applied ecology. Climate change and insect pest/ natural enemy population; ecological engineering.

Practical

- Types of distributions of organisms;
- Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters- Measures of central tendencies, Poisson Distribution, Negative Binomial Distribution;
- Determination of optimal sample size. Learning to fit basic population growth models and testing the goodness of fit; • Fitting Holling's Disc equation;
- Assessment of prey-predator densities from natural systems and understanding the correlation between the two;
- Assessing and describing niche of some insects of a single guild; • Calculation of niche breadth, activity breadth and diagrammatic representation of niches of organisms;
- Calculation of diversity indices- Shannon's, Simpson's and Avalanche Index and understanding their associations and parameters that affect their values;
- Problem solving in ecology. Field visits to understand different ecosystems and to study insect occurrence in these systems

Suggested Readings

Begon M, Townsend CR and Harper JL. 2006. Ecology: From Individuals to Ecosystems. 4th Ed. Blackwell Publishing, USA/ UK/ Australia.

Chapman JL and Reiss MJ. 2006. Ecology: Principles and Applications. 2nd Ed. Cambridge University Press, Cambridge.



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Krebs CJ. 2001. Ecology: The Experimental Analysis of Distribution and Abundance. 5th Ed. Benjamin-Cummings Publ. Co., New York.

Magurran AE. 1988. Ecological Diversity and its Measurement. Princeton Univ. Press, Princeton.

Price PW. 1997. Insect Ecology. 3rd Ed. John Wiley, New York.

Real LA and Brown JH. (Eds). 1991. Foundations of Ecology: Classic Papers with Commentaries. University of Chicago Press, Chicago.

Schowalter Timothy D. 2011. Insect Ecology – An Ecosystem Approach. 3rd Ed. Academic Press, London, UK/ CA, USA.

Southwood TRE and Henderson PA. 2000. Ecological Methods. 3rd Ed. Methuen and Co. Ltd., London.

Speight MR, Hunta MD and Watt AD. 2006. Ecology of Insects: Concepts and Application. Elsevier Science Publ., The Netherlands.

Townsend Colin R, Begon Michael and Harper John L. 2008. Essentials of Ecology. 3rd Ed. Blackwell Publishing, USA/ UK/ Australia.

Wilson EO, William H and Bossert WH. 1971. A Primer of Population Biology. Harvard University, USA.

Wratten SD and Fry GLA. 1980. Field and Laboratory Exercises in Ecology. Arnold, London.

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ENT- 510 : Concepts of Integrated Pest Management (2+0)

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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*			
ENT 508	Concepts of Integrated Pest Management	50	40	10	0	0	2	0	2

Legends: L - Lecture; P – Practical;

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

Aim of the course:

To familiarize the students with principles of insect pest management, including concept and philosophy of IPM. Train students in computation of ETL and implementing IPM programmes.

Theory

Unit I

History, origin, definition and evolution of various terminologies. Importance of resistance, principles, classification, components, types and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide and pheromone registration procedures; label claim of pesticides – the pros and cons.

Unit II

Concept and philosophy, ecological principles, economic threshold concept and economic consideration. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects.

Unit III



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direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses.

Unit V

Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.

Suggested Readings

Dhaliwal GS and Arora R. 2003. Integrated Pest Management – Concepts and Approaches. Kalyani Publishers, New Delhi.

Horowitz AR and Ishaaya I. 2004. Insect Pest Management: Field and Protected Crops. Springer, New Delhi.

Ignacimuthu SS and Jayaraj S. 2007. Biotechnology and Insect Pest Management. Elite Publ., New Delhi.

Norris RF, Caswell-Chen EP and Kogan M. 2002. Concepts in Integrated Pest Management. Prentice Hall, New Delhi.

Pedigo RL. 2002. Entomology and Pest Management. 4th Ed. Prentice Hall, New Delhi.

Subramanyam B and Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

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ENT 511 Post Harvest Entomology 1+1

Course code	Course Name	TEACHING & EVALUATION SCHEME							
		THEORY			PRACTICAL		L	P	CREDITS
		END SEM University Exam	Mid Term Exam	Teachers Assessment*	END SEM University Exam	Teacher's Assessment*			
ENT 511	Post Harvest Entomology	00	00	00	60	40	1	1	2

Legends: L - Lecture; P – Practical;

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

Aim of the course:

To focus on requirement and importance of grain and grain storage, to understand the role of stored grain pests and to acquaint with various stored grain pest management techniques for avoiding losses in storage.

Theory

Unit I

Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses in toto vis-à-vis total production of food grains in India. Scientific and socio-economic factors responsible for grain losses. Concept of seed vault.

Unit II

Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies.

Unit III

Type of losses in stored grains and their effect on quality including biochemical changes



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Unit V

Preventive measures- Hygiene/ sanitation, disinfestations of stores/ receptacles, legal methods. Curative measures- Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Chemical control prophylactic and curative- Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Insecticide resistance in stored product pests and its management; recent advances (MAS, PPP, HS) in storage pest management; integrated approaches to stored grain pest management.

Practical

- Collection, identification and familiarization with the stored grains/ seed insect pests and nature of damage caused by them;
- Detection of hidden insect infestation in stored food grains;
- Estimation of uric acid content in infested produce; estimation of losses in stored food grains;
- Determination of moisture content in stored food grains;
- Familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques;
- Treatment of packing materials and their effect on seed quality;
- Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, Mysore; IGSMRI, Hapur, etc. (only where logistically feasible)

Suggesting Reading

Hall DW. 1970. Handling and Storage of Food Grains in Tropical and Subtropical Areas. FAO. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series No. 19, FAO, Rome.

Jayas DV, White NDG and Muir WE. 1995. Stored Grain Ecosystem. Marcel Dekker, New York.

Khader V. 2004. Textbook on Food Storage and Preservation. Kalyani Publishers, New Delhi.

Khare BP. 1994. Stored Grain Pests and Their Management. Kalyani Publishers, New Delhi.

Subramanyam B and Hagstrum DW. 1995. Interrelated Management of Insects in Stored Products. Marcel Dekker, New York.



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PL PATH 502 Plant Virology 2+1

Course code	Course Name	TEACHING & EVALUATION SCHEME							
		THEORY			PRACTICAL		L	P	CREDITS
		END SEM University Exam	Mid Term Exam	Teachers Assessment*	END SEM University Exam	Teacher's Assessment*			
PL PATH 502	Plant Virology	50	30	00	15	05	2	1	3

Legends: L - Lecture; P – Practical;

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

Aim of the course:

To acquaint with the structure, virus- vector relationship, biology and management of plant viruses.

Theory

Unit I

History and economic significances of plant viruses. General and morphological characters, composition and structure of viruses. Myco-viruses, arbo and baculo viruses, satellite viruses, satellite RNAs, phages, viroids and prions.

Unit II

Origin and evolution of viruses and their nomenclature and classification. Genome organization, replication in selected groups of plant viruses and their movement in host. Response of the host to virus infection: biochemical, physiological, and symptomatic changes.

Unit III

Transmission of viruses and virus-vector relationship. Isolation and purification of viruses. Detection and identification of plant viruses by using protein and nucleic acid based diagnostic techniques.



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- Bioassay of virus cultures on indicator plants and host differentials;
- Transmission of plant viruses (Mechanical, graft and vector and study of disease development);
- Plant virus purification (clarification, concentration, centrifugation, high resolution separation and analysis of virions), Electron microscopy for studying viral particle morphology;
- Antisera production, Detection and diagnosis of plant viruses with serological (ELISA), nucleic acid (Non-PCR–LAMP, Later flow micro array and PCR based techniques);
- Exposure to basic bio-informatic tools for viral genome analysis and their utilization in developing detection protocols and population studies (BLASTn tool, Primer designing software, Bioedit tool, Clustal X/W, MEGA Software).

Suggested Readings

Bos L. 1964. Symptoms of Virus Diseases in Plants. Oxford & IBH., New Delhi.

Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ & Watson L. 1995. Virus of Plants: Descriptions and Lists from VIDE Database. CABI, Wallington.

Gibbs A & Harrison B. 1976. Plant Virology - The Principles. Edward Arnold, London.

Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Oxford & IBH, New Delhi.

Wilson C. 2014. Applied Plant Virology. CABI Publishing England

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PL PATH 506 Techniques for Detection and Diagnosis of Plant Diseases 2+1

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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*			
PL PATH 506	Techniques for Detection and Diagnosis of Plant Diseases	00	00	00	60	40	0	2	2

Legends: L - Lecture; P – Practical;

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

Objective

Aim of the course:

To impart training on various methods/ techniques/ instruments used in the study of plant diseases/ pathogens.

Practical

- Detection of plant pathogens 1. Based on visual symptoms, 2. Biochemical test 3. Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1 222 Using microscopic techniques, 4. Cultural studies; (use of selective media to isolate pathogens). 5. Biological assays (indicator hosts, differential hosts) 6. Serological assays 7. Nucleic acid based techniques (Non-PCR–LAMP, Later flow microarray and PCR based- multiplex, nested, qPCR, immune capture PCR, etc.);
- Phenotypic and genotypic tests for identification of plant pathogens;
- Molecular identification (16S rDNA and ITS region) and whole DNA intergenic spacer region sequences-prokaryotic organisms; and eukaryotic organism by ITS region) and whole



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Dhingra OD and Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo. Fox RTV. 1993. Principles of Diagnostic Techniques in Plant Pathology, CABI Wallington.

Forster D and Taylor SC. 1998. Plant Virology Protocols: From Virus Isolation to Transgenic Resistance. Methods in Molecular Biology. Humana Press, Totowa, New Jersey.

Mathews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Boca Raton, Tokyo.

Matthews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Florida.

Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Cent. Agric. Pub. Doc. Wageningen.

Pathak VN. 1984. Laboratory Manual of Plant Pathology. Oxford & IBH, New Delhi.

Trigiano RN, Windham MT and Windham AS. 2004. Plant Pathology-Concepts and Laboratory Exercises. CRC Press, Florida. Chakravarti BP. 2005. Methods of Bacterial Plant Pathology. Agrotech, Udaipur

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PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Course code	Course Name	TEACHING & EVALUATION SCHEME							
		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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PGS 502

TECHNICAL WRITING AND COMMUNICATIONS SKILLS
(0+1)

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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 502	Technical Writing And Communications Skills	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 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 (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;



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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 (1+0)

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		END SEM University Exam	Mid Term Exam	Teachers Assessment*	END SEM University Exam	Teacher's Assessment*			
PGS 503	Intellectual Property and Its Management in Agriculture	50	40	10	00	00	1	0	1

Legends: L - Lecture; P – Practical;

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

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 knowledgebased 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;



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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. Erbisch 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. 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; The Biological Diversity Act, 2002.

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