

## Biotechnology Centre

**Name of the Programme:**

**M.Sc. (Ag) Molecular Biology and Biotechnology**

**Courses offer in Master Degree programme**

<b>Group</b>		<b>Number</b>	<b>Title of Course</b>	<b>Credit</b>
<b>Major</b>	1.	MBB 501	Principles of biotechnology	3(2+1)
	2.	MBB 502	Fundamentals of molecular biology	3(3+0)
	3.	MBB 503	Molecular cell biology	3(3+0)
	4.	MBB 504	Plant tissue culture & genetic transformation	3(1+2)
	5.	MBB 505	Techniques in molecular biology I	3(0+3)
	6.	MBB 506	Microbial/ industrial biotechnology	3(2+1)
	7.	MBB 507	Molecular breeding	2(2+0)
	<b>Total</b>			<b>20 (13+7)</b>
<b>Seminar</b>	1	MBB 591	Credit Seminar	<b>1(0+1)</b>
<b>Thesis research</b>	1	MBB 599	Research	<b>20(0+20)</b>
<b>Minor</b>	1.	GP 501	Principles of Genetics	3(2+1)
	2.	PP 503	Physiological and molecular responses of plants to abiotic stresses	3(2+1)
	3.	PP 510	Physiological and molecular aspects of photosynthesis carbon and nitrogen assimilation	3(2+1)
	<b>Total</b>			<b>9 (6+3)</b>
<b>Supporting</b>	1.	MBB 510	Biosafety, IPR and bioethics	2(2+0)
	2.	MBB 553	Biostatistics and computers	3(2+1)
	<b>Total</b>			<b>5(4+1)</b>
<b>Non-Credit Compulsory Course</b>	1.	PGS 501	Library and Information Services	1(0+1)
	2.	PGS 502	Technical Writing and Communications Skills	1(0+1)
	3.	PGS 503	Intellectual Property and its Management in Agriculture	1(1+0)
	4.	PGS 504	Basic Concepts in Laboratory Techniques	1(0+1)
	5.	PGS 505	Agri Res. Ethics and Rural Dev. Programs	1(1+0)
	6.	PGS 506	Disaster Management	1(1+0)
	7.		Human value and Professional Ethics	2(1+1)
	<b>Total</b>			<b>8(4+4)</b>
<b>Grand total</b>				<b>63(27+36)</b>

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**Minimum credit requirements**

<b>Subject</b>	<b>Master</b>
<b>Major</b>	20
<b>Minor</b>	09
<b>Supporting</b>	05
<b>Seminar</b>	01
<b>Thesis research</b>	20
<b>Total</b>	<b>55</b>

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### Semester wise distribution of courses

Course	Course Title	Course No	Credit
<b>Semester-I</b>			
<b>Major</b>	Principles of biotechnology	MBB 501	3(2+1)
	Fundamentals of molecular biology	MBB 502	3(3+0)
	Molecular cell biology	MBB 503	3(3+0)
<b>Minor</b>	Principles of Genetics	GP 501	3(2+1)
	Physiological and molecular responses of plants to abiotic stresses	PP 503	3(2+1)
<b>Supporting Compulsory NC</b>	Biostatistics and computers	MBB 553	3(2+1)
	Library and information services	PGS 501	1(0+1)
	Intellectual property and its management in agriculture	PGS 503	1(1+0)
	Basic Concept in Laboratory Techniques	PGS 504	1(0+1)
	Human value and professional ethics	HEV	2(1+1)
<b>Semester-II</b>			
<b>Major</b>	Plant tissue culture & genetic transformation	MBB 504	3(1+2)
	Techniques in molecular biology I	MBB 505	3(0+3)
	Microbial/ industrial biotechnology	MBB 506	3(2+1)
	Molecular breeding	MBB 507	2(2+0)
<b>Minor</b>	Physiological and molecular aspects of photosynthesis carbon and nitrogen assimilation	PP 510	3(2+1)
	<b>Supporting (any one) Compulsory NC</b>	Introduction to bioinformatics	MBB 555
Biosafety, IPR and bioethics		MBB 510	2(2+0)
Technical writing and communications skills		PGS 502	1(0+1)
Agriculture research, research ethics and rural development programme		PGS 505	1(1+0)
Disaster management		PGS 506	1(1+0)
<b>Semester-III</b>			
	<b><i>Written comprehensive exam</i></b>		
	Master's research	MBB 599	10 (0+10)
Major	Master's seminar	MBB 591	1 (0+1)
<b>Semester-IV</b>	Master's research	MBB 599	10(0+10)

*Agricultural Statistics not offered*







**MBB 504**      **Plant Tissue Culture and Genetic Transformation**      **1+2**

**Objective**      To familiarize the students and provide hands on training on various techniques of plant tissue culture, genetic engineering and transformation.

**Theory**

**UNIT I**      History of plant cell and tissue culture; Culture media; Various types of culture; callus, suspension, nurse, root, meristem, etc.; *In vitro* differentiation organogenesis and somatic embryogenesis; Plant growth regulators mode of action, effects on *in vitro* culture and regeneration; Molecular basis of plant organ differentiation.

**UNIT II**      Micropropagation; Anther and microspore culture; Somaclonal variation; *In vitro* mutagenesis; *In vitro* fertilization; *In vitro* germplasm conservation; Production of secondary metabolites; Synthetic seeds.

**UNIT III**      Embryo rescue and wide hybridization; Protoplast culture and regeneration; Somatic hybridization protoplast fusion, cybrids, asymmetric hybrids, etc.

**UNIT IV**      Methods of plant transformation; Vectors for plant transformation; Genetic and molecular analyses of transgenics; Target traits and transgenic crops; Biosafety issues, testing of transgenics, regulatory procedures for commercial approval.

**Practical**

- Laboratory set-up.
- Preparation of nutrient media; handling and sterilization of plant material; inoculation, subculturing and plant regeneration.
- Anther and pollen culture.
- Embryo rescue.
- Suspension cultures and production of secondary metabolites.
- Protoplast isolation, culture and fusion.
- Gene cloning and vector construction
- Gene transfer using different methods, reporter gene expression, selection of transformed tissues/plants, molecular analysis.

**Suggested Readings**

- Bhojwani SS. 1983. Plant Tissue Culture Theory and Practice. Elsevier.  
Christou P & Klee H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons.  
Dixon RA. 2003. Plant Cell Culture. IRL Press.  
George EF, Hall MA & De Klerk GJ. 2008. Plant Propagation by Tissue Culture. Agritech Publ.  
Gupta PK. 2004. Biotechnology and Genomics. Rastogi Publ.  
Herman EB. 2005-08. Media and Techniques for Growth, Regeneration and Storage. Agritech Publ.  
Pena L. 2004. Transgenic Plants Methods and Protocols. Humana Press.  
Pierik RLM. 1997. *In vitro* Culture of Higher Plants. Kluwer.  
Singh BD. 2007. Biotechnology Expanding Horiozon. Kalyani.





<b>MBB 506</b>	<b>Microbial / Industrial Biotechnology</b>	<b>2+1</b>
<b>Objective</b>	To familiarize about the various microbial processes/systems/activities, which have been used for the development of industrially important products/processes.	
<b>Theory</b>		
<b>UNIT I</b>	Introduction, scope and historical developments; Isolation, screening and genetic improvement (involving classical approaches) of industrially important organisms.	
<b>UNIT II</b>	Primary metabolism products, production of industrial ethanol as a case study; Secondary metabolites, bacterial antibiotics and non ribosomal peptide antibiotics; Recombinant DNA technologies for microbial processes; Strategies for development of industrial microbial strains with scale up production capacities; Metabolic pathway engineering of microbes for production of novel product for industry.	
<b>UNIT III</b>	Microbial enzymes, role in various industrial processes, production of fine chemicals for pharmaceutical industries; Bio-transformations, Bioaugmentation with production of vitamin C as a case study; Bioreactors, their design and types; Immobilized enzymes based bioreactors; Microencapsulation technologies for immobilization of microbial enzymes.	
<b>UNIT IV</b>	Industrial biotechnology for pollution control, treatment of industrial and other wastes, biomass production involving single cell protein; Bioremediation of soil; Production of eco-friendly agricultural chemicals, biopesticides, bio-herbicides, bio-fertilizers, bio-fuels, etc.	
<b>Practical</b>	<ul style="list-style-type: none"><li>• Isolation of industrially important microorganisms, their maintenance and improvement.</li><li>• Production of industrial compounds such as alcohol, beer, citric acid, lactic acid and their recovery.</li><li>• Study of bio-reactors and their operations.</li><li>• Production of biofertilizers.</li><li>• Experiments on microbial fermentation process, harvesting purification and recovery of end products.</li><li>• Immobilization of cells and enzymes, studies on its kinetic behavior, growth analysis and biomass estimation.</li><li>• Determination mass transfer co-efficients.</li></ul>	

### **Suggested Readings**

- Huffnagle GB & Wernick S. 2007. *The Probiotics Revolution The Definitive Guide to Safe, Natural Health.* Bantam Books.
- Kun LY. 2006. *Microbial Biotechnology.* World Scientific.
- Primrose SB. 2001. *Molecular Biotechnology.* Panima.





**PP 503                      Physiological and Molecular Responses of Plants to Abiotic Stresses                      2+1**

**Objective**                      To apprise the students regarding abiotic stress to plant and its molecular basis.

**Theory**

**UNIT I**                      Response of plants to abiotic stresses: Abiotic stresses affecting plant productivity. Basic principles of a crop improvement programme under stress, Interactions between biotic and abiotic stresses.

**UNIT II**                      Drought-characteristic features, Water potential in the soil-Plant air continuum. Development of water deficits, energy balance concept.

**UNIT III**                      Transpiration and its regulation – stomatal functions.

**UNIT IV**                      Physiological processes affected by drought. Drought resistance mechanisms: Escape Dehydration postponement (Drought avoidance), Dehydration tolerance and characteristics of resurrection plants. Osmotic adjustment, Osmoprotectants, Stress proteins. Water use efficiency as a drought resistant trait.

**UNIT V**                      Molecular responses to water deficit: Stress perception, Expression of regulatory and functional genes and significance of gene products.

**UNIT VI**                      Stress and hormones- ABA as a signaling molecule- Cytokinin as a negative signal. Oxidative stress: Reactive Oxygen Species. Role of scavenging systems.

**UNIT VII**                      High temperature stress: Tolerance mechanisms- role of membrane lipids in high temperature tolerance. Functions of HSP's.

**UNIT VIII**                      Chilling stress: Effects on physiological processes. Crucial role of membrane lipids.

**UNIT IX**                      Salinity: Species variation in salt tolerance. Salinity effects at – Cellular and whole plant level, tolerance mechanisms. Salt tolerance in – Glycophytes and halophytes, Breeding for salt resistance.

**UNIT X**                      Heavy metal stress: Aluminium and cadmium toxicity in acid soils. Role of Phytochelatin (heavy metal binding proteins).

**Practical**

- Measurement of water status of plants, determination of osmotic potential by vapour pressure and freezing point depression.
- Determination of soil water potential and content by psychrometry and other systems. Stress imposition and quantification, Stress –stomatal conductance. Canopy temperature as a reflection of transpiration and root activity, Water use – efficiency, Determination at whole plant and single leaf level, Root- shoot signals-ABA and cytokinin effect on stomatal behavior.
- Heat tolerance and membrane integrity. Sullivans heat tolerance test, chilling tolerance- Galactolipase and free fatty acid levels as biochemical markers for chilling damage, Cold induced inactivation of O<sub>2</sub> evolution of chloroplasts- as a screening technique for chilling tolerance.

**Suggested Readings**

Hopkins WG & Huner NPA. 2004. Introduction to Plant Physiology. John Wiley & Sons.  
Salisbury FB & Ross C. 1992. Plant Physiology. 4th Ed. Wadsworth Publ.  
Taiz L & Zeiger E. 2006. Plant Physiology. 4th Ed. Sinauer Associates.

<b>PP 510</b>	<b>Physiological and Molecular Aspects of Photosynthesis-Carbon and Nitrogen Assimilation</b> <b>2+1</b>
<b>Objective</b>	To impart knowledge about physiological and molecular aspects of carbon reduction cycle and nitrogen assimilation.
<b>Theory</b>	
<b>UNIT I</b>	Photosynthesis- its significance in plant growth, development and bio productivity. Gaseous fluxes in atmosphere.
<b>UNIT II</b>	Physiological and biochemical aspects: chloroplast structure development and replication, ultra structure of thylakoids, photo systems, mechanism of light absorption, chloroplast electron transport chain, Coupling factors and mechanisms of ATP synthesis, and concept of quantum yield.
<b>UNIT III</b>	Photosynthetic carbon reduction cycle and its regulation. CO <sub>2</sub> Concentration Mechanism (CCM) as a complementary strategy for carbon fixation. CCM in photosynthetic bacteria, micro algae, Submerged Aquatic macrophages, C <sub>4</sub> , CAM and single celled C <sub>4</sub> organisms, C <sub>3</sub> intermediates. Ecological significance of CCM.
<b>UNIT IV</b>	Rubisco structure, assembly and kinetics, photorespiration and its significance.
<b>UNIT V</b>	Carbon fluxes between chloroplast and cytoplasm and Carbon fixation as a diffusive process, the concept of $r_a$ , $r_s$ and $r_m$ . Pi recycling, starch and sucrose synthesis and export. Concept of canopy photosynthesis, influence of environmental factors such as water stress, high light stress VPD etc.
<b>UNIT VI</b>	Molecular aspects: chloroplast genome organization, expression and regulation of plastid genes Genes regulating potential traits of photosynthesis, biotechnological approaches for improving photosynthetic rate and productivity– transgenics. Conceptual approaches of expressing C <sub>4</sub> photosynthesis genes in C <sub>3</sub> species.
<b>UNIT VII</b>	Photosynthesis and crop productivity, energy utilization efficiency by crops. Photo inhibition, photo oxidation, excitation energy dissipation mechanisms, photochemical and non-photochemical quenching of chlorophyll fluorescence. Photosynthesis and transpiration interaction, significance of WUE, carbon isotope discrimination concept.
<b>UNIT VIII</b>	Prospects of improving photo synthetic rate and productivity – potential traits of photosynthesis- biotechnological approaches.
<b>UNIT IX</b>	Nitrogen assimilation in photosynthesizing cells – NO <sub>3</sub> , NO <sub>3</sub> , reduction, GS-GOGAT pathway. Photorespiration loss of Ammonia and its re-assimilation and NUE.
<b>Practical</b>	Extraction and separation of plant pigments, Isolation of chloroplasts ETC reactions- O evolution, Determination of rubisco content (western and ELISA), activity and activation state, Enzymatic determination of starch and sucrose, Determination of photosynthetic rates –gas exchange. $A$ , $g_s$ , $C_i$ , $A/g_s$ , $C/g_s$ - intrinsic WUE by gas exchange rates. Light, CO <sub>2</sub> , VPD response curves, Determination of photorespiration by TPSAPS. Genotypic/species differences in photosynthetic rates. Measurement of radiation, $E_u$ % light interception, Determination of NH <sub>4</sub> <sup>+</sup> , reduction of inorganic nitrogen species.

### **Suggested Readings**

Edwin Oxlade & Graham Lawler 2007. Plant Physiology: The Structure of Plants Explained. John Wiley  
Hopkins WG & Huner NPA. 2004. Introduction to Plant Physiology. John Wiley & Sons.  
Salisbury FB & Ross C. 1992. Plant Physiology. 4th Ed. Wadsworth Publ.  
Taiz L & Zeiger E. 2006. Plant Physiology. 4th Ed. Sinauer Associates.

*Supporting course*

<b>MBB 510</b>	<b>Biosafety, IPR and Bioethics</b>	<b>2+0</b>
<b>Objective</b>	To discuss about various aspects of biosafety regulations, IPR and bioethics concerns arising from the commercialization of biotech products.	
<b>Theory</b>		
<b>UNIT I</b>	Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO and other international agreements related to biosafety, Cross border movement of germplasm; Risk management issues - containment.	
<b>UNIT II</b>	General principles for the laboratory and environmental biosafety; Health aspects; toxicology, allergenicity, antibiotic resistance, etc; Impact on environment gene flow in natural and artificial ecologies; Sources of gene escape, tolerance of target organisms, creation of superweeds/superviruses, etc.	
<b>UNIT III</b>	Ecological aspects of GMOs and impact on biodiversity; Monitoring strategies and methods for detecting transgenics; Radiation safety and nonradio isotopic procedure; Benefits of transgenics to human health, society and the environment.	
<b>UNIT IV</b>	The WTO and other international agreements; Intellectual properties, copyrights, trademarks, trade secrets, patents, geographical indications, etc; Protection of plant variety and farmers right act; Indian patent act and amendments, patent filing; Convention on biological diversity; Implications of intellectual property rights on the commercialization of biotechnology products.	

**Suggested Readings**

Singh BD. 2007. Biotechnology Expanding Horizon. Kalyani.  
<http://www.patentoffice.nic.in>  
<http://www.wipo.org>  
<http://www.dbtindia.nic.in>  
<http://www.dbtbiosafety.nic.in>



*Supporting course*

<b>MBB 555</b>	<b>Introduction to Bioinformatics</b>	<b>2+1</b>
<b>Objective</b>	To impart an introductory knowledge about the subject of bioinformatics to the students studying any discipline of science.	
<b>Theory</b>		
<b>UNIT I</b>	Introduction, biological databases-primary, secondary and structural, Protein and Gene Information Resources-PIR, SWISSPROT, PDB, genebank, DDBJ. Specialized genomic resources.	
<b>UNIT II</b>	DNA sequence analysis, cDNA libraries and EST, EST analysis, pairwise alignment techniques, database searching, multiple sequence alignment.	
<b>UNIT III</b>	Secondary database searching, building search protocol, computer aided drug design – basic principles, docking, QSAR.	
<b>UNIT IV</b>	Analysis packages-commercial databases and packages, GPL software for Bioinformatics, web-based analysis tools.	
<b>Practical</b>	<ul style="list-style-type: none"><li>• Usage of NCBI resources</li><li>• Retrieval of sequence/structure from databases</li><li>• Visualization of structures</li><li>• Docking of ligand receptors</li><li>• BLAST exercises.</li></ul>	

**Suggested Readings**

Attwood TK & Parry-Smith DJ. 2003. Introduction to Bioinformatics. Pearson Education.  
Rastogi SC, Mendiratta N & Rastogi P. 2004. Bioinformatics Concepts, Skills and Applications. CBS.



*Non-Credit Compulsory Course*

**PGS 501                      Library and Information Services                      1(0+1)**

**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; ere sources access methods.

**PGS 504                      Basic Concepts in Laboratory Techniques                      1(0+1)**

**Objective**                      To acquaint the students about the basics of commonly used techniques in laboratory.

**Practical**                      Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccumets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

**Suggested Readings**

Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.

Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

**PGS 505                      Agriculture Research, Research Ethics and Rural Development Program's                      1(1+0)**

**Objective**                      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.

**Theory**

- 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 Centres (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 Organisations. 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.
- Singh K.. 1998. Rural Development Principles, Policies and Management. Sage Publ.

### **PGS 506 Disaster Management 1(1+0)**

**Objective** To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

#### **Theory**

- UNIT I** Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change Global warming, Sea Level rise, Ozone Depletion
- UNIT II** Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.
- UNIT III** Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response Police and other organizations.



Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; 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; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; 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 FH & 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.