

# **DAV UNIVERSITY, JALANDHAR**



FACULTY OF AGRICULTURAL SCIENCES

COURSE CURRICULUM

FOR

M. Sc. Ag. (Hort.) Vegetable Science

(2 Years Course)

1<sup>st</sup> to 4<sup>th</sup> SEMESTER

Examinations 2018–2019 session

Syllabi applicable for admissions in 2018

**Scheme of Courses M.Sc. Ag. (Hort.) Vegetable Science  
Semester I**

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	AGS551	Production Technology of cool season vegetable crops	Core	2	0	2	3
2	AGS552	Breeding of vegetable crops	Core	2	0	2	3
3	AGS553	Growth and development of vegetable crops	Core	2	0	2	3
4	AGS554	Post harvest management of vegetable crops	Core	2	0	2	3
5	Open elective or Interdisciplinary elective-I			2	0	2	3
6	CSA559	Computer Fundamentals and Programming	Compulsory Foundation	2	0	2	3

L=Lecture; T= tutorial; P=Practical; Cr=Credit

**Semester II**

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	AGS555	Production Technology of summer season vegetable crops	Core	2	0	2	3
2	AGS556	Seed production technology of vegetable Crops	Core	2	0	2	3
3	Departmental elective- II			1	0	2	2
4	Open elective or Interdisciplinary elective-I			2	0	2	3
5	ENG 551	Technical writing and communications skills	Compulsory foundation	0	1	2	1
6	AGS503	Intellectual property and its management in agriculture	Compulsory foundation	0	1	2	1
	AGS500	Research	Core	0	4	8	4

L=Lecture; T= tutorial; P=Practical; Cr=Credit

### Departmental elective II

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	AGS557	Fundamentals of processing of vegetables	Elective	1	0	2	2
2	AGS558	Systematics of vegetable crops	Elective	1	0	2	2
3	AGS559	Production technology of underexploited vegetable crops	Elective	1	0	2	2

L=Lecture; T= tutorial; P=Practical; Cr=Credit

### Semester III

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	AGS560	Master's Seminar	Core	0	1	2	1
2	MTH670	Statistical method for applied sciences	Compulsory Foundation	3	0	2	4
3	AGS504	Basic Concepts In Laboratory Techniques	Compulsory Foundation	0	1	2	1
4	AGS505	Agricultural Research, Research Ethics And Rural Development Programmes	Compulsory Foundation	1	0	0	1
5	LIB101	Library And Information Services	Compulsory Foundation	0	1	2	1
6	EVS658	Disaster Management	Compulsory Foundation	1	0	0	1
7	AGS500	Research	Core	0	6	12	6

L=Lecture; T= tutorial; P=Practical; Cr=Credit

### Semester IV

S. No	Paper Code	Course Title	Course Type	L	T	P	Cr
1	AGS500	Research	Core	0	15	30	15

L=Lecture; T= tutorial; P=Practical; Cr=Credit

## Syllabus

### AGS 551 PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS 2+1

**Objective:** To educate production technology of cool season vegetables.

**Outcome:** The students will be acquainted with the production technology of important cool season vegetable crops

Theory: Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of:

#### SECTION A

Potato , Bulb crops: onion and garlic

#### SECTION B

Cole crops: cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels sprout

#### SECTION C

Root crops: carrot, radish, turnip and beetroot

#### SECTION D

Peas and broad bean, green leafy cool season vegetables

**Practical:** Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economics; Experiments to demonstrate the role of mineral elements, plant growth substances and herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/ polyhouse

#### Suggested Readings

Bose TK & Som MG. (Eds.). 1986. Vegetable Crops in India.

Naya Prokash. Bose TK, Som G & Kabir J. (Eds.). 2002. Vegetable Crops. Naya Prokash.

Bose TK, Som MG & Kabir J. (Eds.). 1993. Vegetable Crops. Naya Prokash.

Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. Vegetable Crops. Vols. I-III.

Naya Udyog. Chadha KL & Kalloo G. (Eds.). 1993-94. Advances in Horticulture Vols. V-X.

Malhotra Publ. House. Chadha KL. (Ed.). 2002. Hand Book of Horticulture. ICAR.

Chauhan DVS. (Ed.). 1986. Vegetable Production in India. Ram Prasad & Sons.

### AGS552: BREEDING OF VEGETABLE CROPS 2+1

#### Objective:

To educate principles and practices adopted for breeding of vegetable crops.

**Outcome:**

The students will be well acquainted with various methods adopted for improvement of vegetable crops.

**Theory**

Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR act for:

## SECTION A

Potato, tomato, sweet potato and tapioca, carrot, beetroot, radish,

## SECTION B

Eggplant, hot pepper, sweet pepper and okra

## SECTION C

Peas and beans, amaranth, chenopods and lettuce

## SECTION D

Gourds, melons, pumpkins and squashes, Cabbage, cauliflower,

**Practical**

Selection of desirable plants from breeding population observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations; induction of flowering, palanological studies, selfing and crossing techniques in vegetable crops; hybrid seed production of vegetable crops in bulk. screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population; molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques. Visit to breeding blocks.

**Suggested Readings**

1. Allard RW. 1999. *Principles of Plant Breeding*. John Wiley & Sons.
2. Basset MJ. (Ed.). 1986. *Breeding Vegetable Crops*. AVI Publ.
3. Dhillon BS, Tyagi RK, Saxena S. & Randhawa GJ. 2005. *Plant Genetic Resources: Horticultural Crops*. Narosa Publ. House.
4. Fageria MS, Arya PS & Choudhary AK. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani.

**AGS553 GROWTH AND DEVELOPMENT OF VEGETABLE CROPS 2+1**

**Objectives:** To develop understanding of growth and development of horticultural crops which have implications in their management.

**outcomes:**

This course will provide knowledge about basic cell functions, growth and development stages, roles and applications of plant growth regulators. It will also acquaint the students with basic physiological processes involved in flowering, fruit set and environmental factors associated.

## SECTION A

Cellular structures and their functions; definition of growth and development, growth analysis and its importance in vegetable production.

## SECTION B

Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins and abscisic acid; Application of synthetic hormones, plant growth retardants and inhibitors for various purposes in vegetable crops.

## SECTION C

Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plantstimulants in vegetable crop production. Role of light, temperature and photoperiod on growth, development of underground parts, flowering and sex expression in vegetable crops; apical dominance. Physiology of fruit set, fruit development, fruit growth, flower and fruit drop.

## SECTION D

Parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening. Plant growth regulators in relation to vegetable production; morphogenesis and tissue culture techniques in vegetable crops.

## PRACTICALS

Preparation of solutions of plant growth substances and their application; experiments in breaking and induction of dormancy by chemicals; induction of parthenocarpy and fruit ripening; application of plant growth substances for improving flower initiation, changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables; growth analysis techniques in vegetable crops.

## Suggested Readings

Bleasdale JKA. 1984. *Plant Physiology in Relation to Horticulture*. 2nd Ed. MacMillan.

Gupta US. (Ed.). 1978. *Crop Physiology*. Oxford & IBH.

Krishnamoorti HN. 1981. *Application Plant Growth Substances and Their Uses in Agriculture*. Tata-McGraw Hill

## **AGS554      Post harvest management of vegetable crops      2+1**

### **Objective**

To educate principles and practices of processing of vegetable crops.

### **Outcome**

The students will know the various ways for value addition in vegetable crops

## SECTION A

History of food preservation. Present status and future prospects of vegetable preservation industry in India.

## SECTION B

Spoilage of fresh and processed horticultural produce; biochemical changes and enzymes associated with spoilage of horticultural produce; principal spoilage organisms, food poisoning and their control measures. Role of microorganisms in food preservation.

## SECTION C

Raw materials for processing. Primary and minimal processing; processing equipments; Layout and establishment of processing industry, FPO licence. Importance of hygiene; Plant sanitation. Quality assurance and quality control, TQM, GMP. Food standards – FPO, PFA, etc. Food laws and regulations.

## SECTION D

Food safety – Hazard analysis and critical control points (HACCP). Labeling and labeling act, nutrition labeling. Major value added products from vegetables. Utilization of byproducts of vegetable processing industry; Management of waste from processing factory. Investment analysis. Principles and methods of sensory evaluation of fresh and processed vegetables.

### **Practical**

Study of machinery and equipments used in processing of horticultural produce; Chemical analysis for nutritive value of fresh and processed vegetables; Study of different types of spoilages in fresh as well as processed horticultural produce; Classification and identification of spoilage organisms; Study of biochemical changes and enzymes associated with spoilage; Laboratory examination of vegetable products; Sensory evaluation of fresh and processed vegetables; Study of food standards – National, international, CODEX Alimentarius; Visit to processing Sections to study the layout, equipments, hygiene, sanitation and residual / waste management.

### **Suggested Readings**

Arthey D & Dennis C. 1996. *Vegetable Processing*. Blackie/Springer- Verlag.  
Chadha DS. 2006. *The Prevention of Food Adulteration Act*. Confed. of Indian Industry.  
Desrosier NW. 1977. *Elements and Technology*. AVI Publ. Co.

**AGS 555      Production Technology of summer season vegetable crops      2+1**

### **Objective**

To teach production technology of warm season vegetables.

### **Outcome**

The students will know the packages of practices of warm season vegetables.

### **Theory**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures, economics of crop production and seed production of:

## SECTION A

Tomato, eggplant, hot and sweet peppers

## SECTION B

Okra, beans, cowpea and clusterbean

## SECTION C

Cucurbitaceous crops

## SECTION D

Tapioca and sweet potato, Green leafy warm season vegetables

### **Practical**

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics; study of physiological disorders and deficiency of mineral elements, preparation of cropping schemes for commercial farms; experiments to demonstrate the role of mineral elements, physiological disorders; plant growth substances and herbicides; seed extraction techniques; identification of important pests and diseases and their control; maturity standards; economics of warm season vegetable crops.

### **Suggested Readings**

- Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. Naya Prokash.
- Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. *Vegetable Crops*. Vols. I-III. Naya Udyog.
- Bose TK, Som MG & Kabir J. (Eds.). 2002. *Vegetable Crops*. Naya Prokash. Brown HD & Hutchison CS. *Vegetable Science*. JB Lippincott Co.
- Chadha KL & Kalloo G. (Eds.). 1993-94. *Advances in Horticulture*. Vols. V-X. Malhotra Publ. House.
- Chadha KL. (Ed.). 2002. *Hand Book of Horticulture*. ICAR. Chauhan DVS. (Ed.). 1986. *Vegetable Production in India*. Ram Prasad & Sons.
- Decoteau DR. 2000. *Vegetable Crops*. Prentice Hall. Edmond JB, Musser AM & Andrews FS. 1964. *Fundamentals of Horticulture*. Blakiston Co
- Fageria MS, Choudhary BR & Dhaka RS. 2000. *Vegetable Crops: Production Technology*. Vol. II. Kalyani.
- Gopalakrishnan TR. 2007. *Vegetable Crops*. New India Publ. Agency.
- Hazra P & Som MG. (Eds.). 1999. *Technology for Vegetable Production and Improvement*. Naya Prokash.
- Kaloo G & Singh K (Ed.). 2000. *Emerging Scenario in Vegetable Research and Development*. Research Periodicals & Book Publ. House.
- Nayer NM & More TA 1998. *Cucurbits*. Oxford & IBH Publ.
- Palaniswamy & Peter KV. 2007. *Tuber Crops*. New India Publ. Agency.
- Pandey AK & Mudranalay V. (Eds.). *Vegetable Production in India: Important Varieties and Development Techniques*.
- Rana MK. 2008. *Olericulture in India*. Kalyani.
- Rana MK. 2008. *Scientific Cultivation of Vegetables*. Kalyani.
- Rubatzky VE & Yamaguchi M. (Eds.). 1997. *World Vegetables: Principles, Production and Nutritive Values*. Chapman & Hall.
- Saini GS. 2001. *A Text Book of Oleri and Flori Culture*. Aman Publ. House.
- Salunkhe DK & Kadam SS. (Ed.). 1998. *Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing*. Marcel Dekker.
- Shanmugavelu KG. 1989. *Production Technology of Vegetable Crops*. Oxford & IBH.
- Singh DK. 2007. *Modern Vegetable Varieties and Production Technology*. International Book Distributing Co.



**AGS556**                      **Seed production technology of vegetable crops**                      **2+1**

**Objective**

To educate principles and methods of quality seed and planting material production in vegetable crops.

**Outcome**

The students will be acquainted with importance of quality seed production various methods of seed production in self and open pollinated crops.

**SECTION A**

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India.

**SECTION B**

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production.

**SECTION C**

Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control.

**SECTION D**

Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology. Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra, vegetatively propagated vegetables.

**Practical**

Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing; testing, releasing and notification procedures of varieties; floral biology; rouging of off-type; methods of hybrid seed production in important vegetable and spice crops; seed extraction techniques; handling of seed processing and seed testing germination, vigour and health; visit to seed processing units, seed testing laboratory and seed production farms.

**Suggested Readings**

Agrawal PK & Dadlani M. (Eds.). 1992. *Techniques in Seed Science and Technology*. South Asian Publ.

Agrawal RL. (Ed.). 1997. *Seed Technology*. Oxford & IBH.

Bendell PE. (Ed.). 1998. *Seed Science and Technology: Indian Forestry Species*. Allied Publ.

Fageria MS, Arya PS & Choudhary AK. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani.

George RAT. 1999. *Vegetable Seed Production*. 2nd Ed. CABI.

Kumar JC & Dhaliwal MS. 1990. *Techniques of Developing Hybrids in Vegetable Crops*. Agro Botanical Publ.

More TA, Kale PB & Khule BW. 1996. *Vegetable Seed production Technology*. Maharashtra State Seed Corp.

Rajan S & Baby L Markose. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency.

Singh NP, Singh DK, Singh YK & Kumar V. 2006. *Vegetable Seed Production Technology*. International Book Distributing Co.

Singh SP. 2001. *Seed Production of Commercial Vegetables*. Agrotech Publ. Academy.

**AGS557      Fundamentals of processing of vegetables**

**1+1**

**Objective**

To educate principles and practices of processing of vegetable crops.

**Outcome**

The students will be acquainted with various ways of increasing shelf life and value addition of vegetables.

**SECTION A**

Maturity indices of horticultural crops, composition and structure of fruits and vegetables and their significance with post harvest management. Harvesting and its relationship with quality, sorting and grading, pre-harvest crop management practices and their influence on quality during storage and marketing.

**SECTION B**

Respiration, ethylene in post-harvest biology, artificial ripening and de-greening of fruits. Physiology of ripening and senescence. Storage system: on-farm storage-evaporatively cooled stores, ventilated storage, pit storage etc. Refrigerated storage refrigeration cycle, controlled/modified atmosphere, hypobaric storage.

**SECTION C**

Application of growth regulators for quality assurance, post-harvest treatments: pre cooling, heat treatments (hot water, hot air and vapor heat), fungicides & biologically safe chemicals, irradiation, curing, pulsing etc. Packing line operations, packaging of horticultural produce. Transportation- rail, road, sea, air. Codex norms for export of perishables.

**SECTION D**

Post harvest diseases of Hort. Products infection process, factors affecting it; modern methods of controlling decay (use of microbial antagonists their mode of action etc).

**Practicals**

Morphological features of some selected fruits and vegetables; maturity indices, harvesting techniques of fruits, field visit & identification of spoilage of fruits and vegetables, on-farm storage/ chilling injury, pre-cooling, CA- treatment post harvest treatments to Hort. produce, pre cooling and storage of fruits and vegetables; studies on pre-treatments of selected fruits; use of chemicals for ripening and enhancing shelf life of fruits and vegetables, various storage systems and structures; pre packaging of fruits; GC for ethylene estimation. Pre packaging of vegetables; physiological disorders-chillign injury of banana and custard apple, Electrolyte leakage/membrane permeability/ RWC HPLC analysis.

## Suggested Readings

- Kadar, A.A. 1992. *Post-harvest Technology of Horticultural Crops*. 2<sup>nd</sup> Ed. University of California.
- Salunkhe, D.K., Bolia, H.R. and Reddy, N.R. 1991. *Storage, Processing and Nutritional Quality of Fruits and Vegetables*. Vol. I. Fruits and Vegetables. CRC.
- Verma, L.R. and Joshi, V.K. 2000. *Post Harvest Technology of Fruits and Vegetables*. Indus Publ.
- Thompson, A.K. 1995. *Post harvest technology of fruits and vegetables*. Blackwell Sciences.
- Peter, K.V. 2003. *Plantation Crops*. NBT, New Delhi.

**AGS558      Systematics of vegetable crops      1+1**

### Objective

To teach morphological, cytological and molecular taxonomy of vegetable crops.

### Outcome

The students will be aware of the origin and evolution of different vegetables

#### SECTION A

Principles of classification; different methods of classification; salient features of international code of nomenclature of vegetable crops.

#### SECTION B

Origin, history, evolution and distribution of vegetable crops, botanical description of families, genera and species covering various tropical, subtropical and temperate vegetables.

#### SECTION C

Cytological level of various vegetable crops; descriptive keys for important vegetables.

#### SECTION D

Importance of molecular markers in evolution of vegetable crops; molecular markers as an aid in characterization and taxonomy of vegetable crops.

### Practical

Identification, description, classification and maintenance of vegetable species and varieties; survey, collection of allied species and genera locally available; preparation of keys to the species and varieties; methods of preparation of herbarium and specimens.

## Suggested Readings

- Chopra GL. 1968. *Angiosperms - Systematics and Life Cycle*. S. Nagin Dutta AC. 1986. *A Class Book of Botany*. Oxford Univ. Press.
- Pandey BP. 1999. *Taxonomy of Angiosperm*. S. Chand & Co.
- Peter KV & Pradeepkumar T. 2008. *Genetics and Breeding of Vegetables*. (Revised), ICAR.
- Soule J. 1985. *Glossary for Horticultural Crops*. John Wiley & Sons.
- Srivastava U, Mahajan RK, Gangopadyay KK, Singh M & Dhillon BS. 2001. *Minimal Descriptors of Agri-Horticultural Crops*. Part-II: *Vegetable Crops*. NBPGR, New Delhi.
- Vasistha. 1998. *Taxonomy of Angiosperm*. Kalyani.
- Vincent ER & Yamaguchi M. 1997. *World Vegetables*. 2nd Ed. Chapman & Hall.

**AGS 559      Production technology of underexploited vegetable crops      2+1**

**Objective**

To educate production technology of underutilized vegetable crops.

**Outcome**

The students will be well versed with package of practices of underexploited vegetables so as to enhance their production.

**SECTION A**

Asparagus, artichoke and leek

**SECTION B**

Brussels's sprout, Chinese cabbage, broccoli, kale and artichoke.

**SECTION C**

Amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathu (chenopods) and chekurmanis.

**SECTION D**

Elephant foot yam, lima bean, winged bean, vegetable pigeon pea, jack bean and sword bean., Sweet gourd, spine gourd, pointed gourd, Oriental pickling melon and little gourd (kundru).

**Practical**

Identification of seeds; botanical description of plants; layout and planting; cultural practices; short-term experiments of underexploited vegetables.

**Suggested Readings**

Bhat KL. 2001. *Minor Vegetables - Untapped Potential*. Kalyani.

Indira P & Peter KV. 1984. *Unexploited Tropical Vegetables*. Kerala. Agricultural University, Kerala.

Peter KV. (Ed.). 2007-08. *Underutilized and Underexploited Horticultural Crops*. Vols. I-IV. New India Publ. Agency.

Rubatzky VE & Yamaguchi M. (Eds.). 1997. *World Vegetables: Principles, Production and Nutritive Values*. Chapman & Hall

Srivastava U, Mahajan RK, Gangopadyay KK, Singh M & Dhillon BS. 2001. *Minimal Descriptors of Agri-Horticultural Crops*. Part-II: *Vegetable Crops*. NBPGR, New Delhi.

**AGS501      LIBRARY AND INFORMATION SERVICES      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.

**Outcome**

The students will be acquainted with basics of library information.

**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**

Wu Diana Yuhfen and Liu Mengxiong. 2001 Academic librarianship: changing roles in the digital age. Available at <http://www.sssu.edu/ridwu/academic> librarianship P&F. Accessed March 10, 2008

Library.2004 Encyclopedia Britannica premium service [http://www.britannica.com/eb/ article eu=09616](http://www.britannica.com/eb/article eu=09616). Accessed March 10, 2008

Young, P.V. (1984). Scientific social survey and research. Rev. 4<sup>th</sup> Ed. Prentice Hall, New Delhi.

<https://guides.library.manoa.hawaii.edu/PlantPath/Books>

<https://unl.libguides.com/c.php?g=51695&p=334113>

<https://libraries.unl.edu/citation-tools>

## **AGS 503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 0+1**

### **SECTION A**

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;

### **SECTION B**

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,

### **SECTION C**

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;

### **SECTION D**

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.

## **AGS504 BASIC CONCEPTS IN LABORATORY TECHNIQUES 0+1** **Objectives**

To explain students about the basic lab techniques, instruments and their use with their applications in research and precautionary measures in lab.

## **Outcome**

Students learn the use of lab instruments and chemicals for their research purposes.

## **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; Neutralisation 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, sandbath, waterbath, oilbath; 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

## **AGS505 AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES 1+0**

### **SECTION A**

History of agriculture in brief; Global agricultural research system: need, scope, opportSectionies; 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):

### **SECTION B**

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.

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

### **SECTION C**

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: CommSectiony Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDp)

### **SECTION D**

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*. Mittal Publ.

## **ENG551 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1**

### **Practical**

**Technical Writing** - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

**Communication Skills** - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

### **Suggested Readings**

*Chicago Manual of Style*. 14th Ed. 1996. Prentice Hall of India.

*Collins' Cobuild English Dictionary*. 1995. Harper Collins.

Gordon HM & Walter JA. 1970. *Technical Writing*. 3rd Ed. Holt, Rinehart & Winston.

## **CSA559 COMPUTER FUNDAMENTALS AND PROGRAMMING 2+1**

### **Objective**

This course builds an understanding of the structure of computers and how they execute programs, data representation and computer arithmetic. The course is also aimed to develop problem-solving strategies, techniques and skills to help students develop the logic, ability to solve the problems efficiently using C programming.

### **Outcome**

The students will have the knowledge of basic principles of computer programming and its application in problem solving

### **Theory**

#### **SECTION A**

Computer Fundamentals - Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, character representation; ASCII, EBCDIC.

## SECTION B

Functional units of computer, I/O devices, primary and secondary memories. Programming Fundamentals with C - Algorithm, techniques of problem solving, flowcharting, stepwise refinement; Representation of integer, character, real, data types; Constants and variables; Arithmetic expressions, assignment statement, logical expression.

## SECTION C

Sequencing, alteration and iteration; Arrays, string processing. Sub-programs, recursion, pointers and files.

## SECTION D

Program correctness; Debugging and testing of programs. Practical Conversion of different number types; Creation of flow chart, conversion of algorithm/flowchart to program; Mathematical operators, operator precedence; Sequence, control and iteration; Arrays and string processing; Pointers and File processing.

**EVS658**

**DISASTER MANAGEMENT**

**1+0**

### **Theory**

#### SECTION A

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

#### SECTION B

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.

#### SECTION C

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

#### SECTION D

Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

### **Suggested Readings**

Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.

Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.

Sharma VK. 2001. *Disaster Management*. National Centre for Disaster Management, India.



**Theory:****Section A**

Classification, tabulation and graphical, representation of data. Box-plot, Descriptive statistics. Exploratory data analysis;

**Section B**

Measures of central tendency- Mean, Median, Mode, Geometric mean, Harmonic mean. Measures of Dispersion- Range, Quartile deviation, Mean deviation, Standard deviation.

**Section C**

Theory of probability. Random variable and mathematical expectation. Discrete and continuous probability distributions. Correlation and regression

**Section D**

Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distributions.

**Practical**

Exploratory data analysis, Box-Cox plots; Fitting of distributions~Binomial, Poisson, Negative Binomial, Normal; Large sample tests, testing of hypothesis based on exact sampling distributions-chi square, t and F; Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution; Correlation and regression analysis, fitting of orthogonal polynomial regression; applications of dimensionality reduction and discriminant function analysis; Nonparametric tests.

**Suggested Readings**

- Anderson TW. 1958. An Introduction to Multivariate Statistical Analysis. John Wiley.  
Goon AM, Gupta MK & Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I  
Goon AM, Gupta MK & Dasgupta B. 1983. Fundamentals of Statistics. Vol. I.  
Hoel PG. 1971. Introduction to Mathematical Statistics. John Wiley.