

**RIMT UNIVERSITY, MANDI GOBINDGARH  
PUNJAB**



**RIMT**  
**UNIVERSITY**

**Pattern of Course Work & Detailed Syllabus  
For  
Ph.D Agriculture  
(Agronomy, Entomology, Food Science and Technology,  
Horticulture and Plant Pathology)**

**Syllabi Applicable For Admissions in 2018 Onwards**

## Pattern of Course Work for Ph.D Programme in Agronomy

Name of Course		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
PHDRM 1101	Research Methodology & Statistical Technique	5	0	0	5	16	---	24	60	100	
PHDCA 1102	Computer Applications in Research	3	0	0	3	16	---	24	60	100	
PHD 1103 A	Advances in Agronomy	5	0	0	5	16	---	24	60	100	3
PHD 1104	Mini Project/Term Paper	-	-	-	2	---	---	---	100	100	
Total											

L	T	P	CWA	LWA	MTE	ETE
Lecture	Tutorial	Practical	Class Work Assessment	Lab Work Assessment	Mid Term Exam	End Term Exam

**SUBJECT TITLE:** Advances in Agronomy

**SUBJECT CODE:** PHD 1103 A

**SEMESTER:** I

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam: 3 Hrs**

**Instruction to Question Paper setter:** The question paper will comprise 12 multiple choice questions, each of one mark; six short answer type questions, each of four marks and three explanatory questions each of eight marks.

**Objective and outcome of course:** The course entails make the student well verse will the agronomical aspect

### **Contents of Syllabus:**

Agriculture, its importance and branches; climate, soil and water in relation to crop production; farm tools and implements; crop seasons; seed structure and germination; phases of plant growth and factors affecting it; mode of propagation; classification and relative status of important crops in the state; importance of water to plants; agronomic practices, seed bed preparation, sowing, fertilizer application; weed control, harvesting, thrashing and marketing of important field crops.

Crop growth analysis in relation to environment. Agro-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law. Mitscherlich yield equation, its interpretation and applicability, Baule unit. Effect of lodging in cereals. Physiology of grain yield in cereals.

Weed biology, ecology and crop-weed competition including allelopathy. Principles and methods of weed control. Weed indices. History and development of herbicide. Classification and selectivity of herbicides based on chemical, physiological application and selectivity. Mode and mechanism of action of important herbicides.

Agro-physiological basis of variation in yield. Recent advances in soil- plant- water relationship. Globalization of agriculture and WTO. Precision agriculture. Contract farming. Organic farming, marketing and export potential of organic products, certification, labeling and accreditation procedures. Water resources of India, irrigation projects, irrigation needs. Atmospheric, soil, agronomic, plant and water factors affecting irrigation need, water deficits and crop growth. Transpiration, evapo-transpiration, significance, energy utilization of transpiration, physiological processes and crop productivity. Farming systems- concept, classification of farming systems according to type of rotation, intensity of rotation, degree of commercialization, water supply, enterprises. Concept of sustainability in farming systems, efficient farming systems, natural resources - identification and management. Production potential of different components of farming systems; interaction and mechanism of different production factors, stability in different systems through research.

### **Recommended Books:**

- Reddy, S.R. 2016. *Principles of Agronomy*. Kalyani Publishers,Ludhiana - 5th edition
- Yellamanda Reddy, T. and Sankara Reddi, G. H. (2016) *Principles of Agronomy*. Kalyani Publishers,Ludhiana.
- Gopal Chandra de.1989.*Fundamentals of Agronomy*. Oxford & IBH Publishing Co. Pvt. Ltd. , New Delhi.
- Gupta,O.P. 2011. *Modern weed management*. Agrobios (India), Jodhpur.

## Pattern of Course Work for Ph.D Programme in Entomology

Name of Course		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
		L	T	P		CWA	LWA	MTE	ETE	Total	
PHDRM 1101	Research Methodology & Statistical Technique	5	0	0	5	16	---	24	60	100	
PHDCA 1102	Computer Applications in Research	3	0	0	3	16	---	24	60	100	
PHD 1103 E	Advances in Entomology	5	0	0	5	16	---	24	60	100	3
PHD 1104	Mini Project/Term Paper	-	-	-	2	---	---	---	100	100	
Total											

L	T	P	CWA	LWA	MTE	ETE
Lecture	Tutorial	Practical	Class Work Assessment	Lab Work Assessment	Mid Term Exam	End Term Exam

**SUBJECT TITLE:** Advances in Entomology

**SUBJECT CODE:** PHD 1103 E

**SEMESTER:** I

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam; 3 Hrs**

**Instruction to Question Paper setter:** The question paper will comprise 12 multiple choice questions, each of one mark; six short answer type questions, each of four marks and three explanatory questions each of eight marks.

**Objective and outcome of course:** The course entails make the student well verse will the entomological aspect

### **Contents of Syllabus:**

**Insect Physiology:** Physiology and biochemistry of insect cuticle and moulting process. Advances in physiology of organ system of insects. Source, chemistry and physiology of insect hormones as regards their growth and development. Biosynthesis of chitin and physiology of chitin synthesis inhibitors. Biochemistry and mode of action of behaviour modifying compounds. Nutrients and their physiological influences in insects. Defence mechanisms in plants against insects.

**Insect Pest Management :** Advances in application of behavior modifying chemicals, insect growth regulators, genetic engineering and other biotechnological strategies for management of insect pests. Strategies for pesticide resistance management and resurgence in insects. Scope and limitations of bio-intensive and ecological based IPM programmes. Applications of IPM to farmers' real time situations. Dynamism of IPM under changing cropping systems and climate; insect pest management under protected cultivation. Advances in pesticide application technology.

**Biological Control:** Effect of abiotic and biotic factors on natural enemies of crop pests. Nutrition of entomophagous insects and their hosts. Dynamics of biocontrol agents vis-à-vis target pest populations. Insectary facilities and equipments. Basic standards of insectary and viable mass-production unit. Colonization of natural enemies. Techniques for release of natural enemies and their recovery. Evaluation of effectiveness of natural enemies. Importance of biotypes in biological control. Survivorship analysis and ecological manipulations.

**Advanced Insecticide Toxicology:** Penetration, binding and distribution of insecticides in insect systems, insecticide selectivity, biochemical and physiological basis of selectivity, toxicodynamics of insecticides. Biochemical and physiological target sites of insecticides in insects, developments in biorationals, biopesticides and newer molecules, their modes of action and structural - activity relationships, metabolism of insecticides. Joint action of insecticides, activation, synergism and potentiation. Pesticide resistance- mechanisms and resistant management strategies. Contribution of genetics to resistance, monogenic and polygenic resistance.

**Host Plant Resistance :** Insect herbivory and plant defense. Genes for plant defense against herbivory. Factors affecting expression of genes. Constitutive and inductive resistance. Biochemistry of induction of resistance. Biotechnological approaches in host plant resistance- genetic manipulations and incorporation of resistant gene(s) in crop varieties. Genetics of host plant resistance. Inheritance of resistance and its estimation Techniques and determination of categories of plant resistance. Breakdown of resistance in crop varieties. Nest founding and construction, brood care, defense and caste determination in social insects.

### **Recommended books**

- Heimpel G E, Mills N J and Brodeur J (2017) Biological Control: Ecology and Applications, Cambridge Press, p. 530
- Hoy M A (2013) Insect Molecular Genetics: An introduction to Principles and Application, 3<sup>rd</sup> ed., Elsevier, p. 779.
- Pedigo L P and Rice M E (2015) Entomology and Pest management, 6<sup>th</sup> Ed., Waveland Press, p. 769
- Nation J L (2016) Insect Physiology and Biochemistry, 3<sup>rd</sup> ed., CRC Press

## Pattern of Course Work for Ph.D Programme in Food Science & Technology

Name of Course		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
PHDRM 1101	Research Methodology & Statistical Technique	5	0	0	5	16	---	24	60	100	
PHDCA 1102	Computer Applications in Research	3	0	0	3	16	---	24	60	100	
PHD 1103 F	Food Science and Technology	5	0	0	5	16	---	24	60	100	3
PHD 1104	Mini Project/Term Paper	-	-	-	2	---	---	---	100	100	
Total											

L	T	P	CWA	LWA	MTE	ETE
Lecture	Tutorial	Practical	Class Work Assessment	Lab Work Assessment	Mid Term Exam	End Term Exam

**SUBJECT TITLE:** Food Science & Technology

**SUBJECT CODE:** PHD 1103 F

**SEMESTER:** I

**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam; 3 Hrs**

**Instruction to Question Paper setter:** The question paper will comprise 12 multiple choice questions, each of one mark; six short answer type questions, each of four marks and three explanatory questions each of eight marks.

**Objective and outcome of course:** The course entails make the student well verse will the food science and technology aspect

### **Contents of Syllabus:**

**Food Chemistry:** Definition and importance; major food constituents and their Physico- chemical properties; role of water in food. Carbohydrates, proteins, lipids, vitamins and minerals: classification, physical, chemical, nutritional, and functional properties and their structural correlations; auto-oxidation of lipids and rancidity. **Food Processing & Preservation:** Physico-chemical properties of Foods, Nutritive aspects of food constituents and effect of processing on them, colours in food & their affect in food processing. Flavors in food , Food additives . Preservation Techniques (Heating, Cooling, Dehydration, Irradiation, Microwave heating & Fermentation). Food Flavors, Application of natural & synthetics flavors & colours, latest trend in the concept of Functional foods, their role in designer foods, nutraceuticals, phytochemicals, antioxidants, genetically modified foods.**Food Spoilage:** Causes of food spoilage. Microorganism in food (mold, yeast, bacteria): primary sources, morphology, cultural characteristics and biochemical activities, of microorganism, factors affecting growth & survival of microorganism in food, physical & chemical means to control microorganism, contamination & spoilage of foods (cereals, sugar, vegetables & fruits, meat, fish, eggs, milk).**Food Analysis:** Chromatographic techniques: Paper, TLC, GC, HPLC, Separation techniques: Gel filtration, dialysis, electrophoresis, ultra filtration and centrifugation, isotopic techniques. Immunoassay techniques; Isotopic, non-isotopic and enzyme immunoassays; thermal methods in food analysis (bomb calorimeter), colour and texture measurement techniques. **Quality Control & Evaluation:** Quality attributes- Physical, Chemical, Nutritional, Microbial & Sensory; Their measurements & evaluation, sensory Vis-avis instrumental methods for testing quality, Governmental Regulation of Food and nutrition labeling, various organizations dealing with inspection , traceability, authentication, certification & quality assurance( PFA, FPO, MPO, AGMARK, BIS etc)

### **Recommended Books:**

- Lal G. Sidappa, C.E. Tandon ,2005. *Preservation of Fruits & Vegetables*.
- .Jay JM, Loessner MJ & Golden DA. 2005. *Modern Food Microbiology*. 7th Ed. Springer.
- Leo ML. 2004. *Handbook of Food Analysis*. 2nd Ed. Vols. I-III.
- Early R.1995.*Guide to Quality Management Systems for Food Industries*. Blackie Academic.

## Pattern of Course Work for Ph.D Programme in Horticulture

Name of Course		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
PHDRM 1101	Research Methodology & Statistical Technique	5	0	0	5	16	---	24	60	100	
PHDCA 1102	Computer Applications in Research	3	0	0	3	16	---	24	60	100	
PHD 1103 H	Advances in Horticulture	5	0	0	5	16	---	24	60	100	3
PHD 1104	Mini Project/Term Paper	-	-	-	2	---	---	---	100	100	
Total											

L	T	P	CWA	LWA	MTE	ETE
Lecture	Tutorial	Practical	Class Work Assessment	Lab Work Assessment	Mid Term Exam	End Term Exam



**SUBJECT TITLE:** Advances in Horticulture  
**SUBJECT CODE:** PHD 1103 H  
**SEMESTER:** I  
**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam; 3 Hrs**

**Instruction to Question Paper setter:** The question paper will comprise 12 multiple choice questions, each of one mark; six short answer type questions, each of four marks and three explanatory questions each of eight marks.

**Objective and outcome of course:** The course entails make the student well verse will the all the aspects of Horticulture.

### Contents of Syllabus:

Elements of Horticulture; types of fruits and vegetables; their economic importance and role in human nutrition; agro-climatic requirements; methods of propagation and cultural practices of important fruits and vegetables in the State; kitchen gardening; introduction to floriculture, landscape and gardening; annual and woody ornamentals.

Definition, importance and divisions of horticulture. Climatic zones, area and production of different fruit crops. Selection of site, fencing and wind break. Planting systems, high density planting, planning and establishment. Propagation methods and use of rootstocks. Methods of training and pruning. Use of growth regulators in fruit production.

Package of practices for the cultivation of - Major fruits -mango, banana, citrus, grapes, guava, sapota, apple, litchi and papaya. Minor fruits - pineapple, annonaceous fruits, pomegranate, ber, fig, loquat, phalsa, jackfruit, pear, plum, peaches, apricot and cherry.

Importance of Olericulture. Vegetable gardens. Vegetable origin, classification, area, production and varieties. Package of practices of tomato, brinjal, chillies and okra. Cucurbitaceous vegetables- cucumber, ridge gourd, ash gourd, snake gourd, bottle gourd, bitter gourd and melons. Cole crops - cabbage, cauliflower and knolkhol. Bulb crops - onion and garlic. Beans and peas - French beans, cluster beans, dolichos beans, peas and cowpea. Tuber crops - potato, sweet potato, tapioca, colocasia, yams. Root crops - carrot, radish, turnip and beet root. Leafy vegetables - amaranthus, palak, methi. Perennial vegetables- drumstick, coccinia and curry leaf. Present status and prospects of vegetable cultivation. Nutritional and medicinal values of vegetables. Sustainable vegetable production, Effect of climate on vegetables, Different farming systems used to improve land use efficiency, Choice of varieties/hybrids for maximizing vegetable production.

Introduction to floriculture and landscaping. Package of practices for rose, jasmine, chrysanthemum, gladiolus, marigold and tuberose. Planning of gardens. Landscape-art principles, Formal and informal gardens. Use of trees, shrubs, climbers, palms, houseplants and seasonal flowers in the gardens. Making and maintenance of lawns. Commercial flower production. Global scenario in cut flower production and trade, varietal wealth and diversity. Soil and Environment. Special characteristics and requirements. Cut flower, loose flowers, dry flowers and floral oil trade. Propagation and multiplication. Commercial landscape gardening- History, Plant identification and ecology. Materials of garden design. Design making by different garden styles and types.

### Recommended Books:

- Chadha, K.L. 2001. *Handbook of Horticulture*. ICAR, New Delhi.
- Jitendra Singh, 2012. *Basic Horticulture*. Kalyani Publishers. New Delhi.
- Randhawa, G.S. and Mukhopadhyaya, A. 1994. *Floriculture in India*. Allied Publishers Pvt. Ltd., New Delhi
- Kumar, N. 1997. *Introduction to Horticulture*. Rajyalakshmi Publications, Nagorcoil, Tamilnadu.

## Pattern of Course Work for Ph.D Programme in Plant Pathology

Name of Course		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
PHDRM 1101	Research Methodology & Statistical Technique	5	0	0	5	16	---	24	60	100	
PHDCA 1102	Computer Applications in Research	3	0	0	3	16	---	24	60	100	
PHD 1103 P	Advances in Plant pathology	5	0	0	5	16	---	24	60	100	3
PHD 1104	Mini Project/Term Paper	-	-	-	2	---	---	---	100	100	
Total											

L	T	P	CWA	LWA	MTE	ETE
Lecture	Tutorial	Practical	Class Work Assessment	Lab Work Assessment	Mid Term Exam	End Term Exam

**SUBJECT TITLE:** Advances in Plant Pathology  
**SUBJECT CODE:** PHD 1103 P  
**SEMESTER:** I  
**CONTACT HOURS/WEEK:**

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
5	0	0	5

**Internal Assessment: 40**

**End Term Exam: 60**

**Duration of Exam; 3 Hrs**

**Instruction to Question Paper setter:** The question paper will comprise 12 multiple choice questions, each of one mark; six short answer type questions, each of four marks and three explanatory questions each of eight marks.

**Objective and outcome of course:** The course entails make the student well verse will the all the aspects of plant pathology.

### **Contents of Syllabus:**

**Ecology of Plant Pathogens:** Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi. Dispersal, survival and dormancy of plant pathogens. Types of biocontrol agents. Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis. Role of rhizosphere, phyllosphere and spermosphere in disease development in relation to crop sequences. Suppressive soils, biological control, concepts and potentialities for managing soil borne pathogens.

**Molecular Basis of Host-Pathogen Interaction:** Importance and role of biotechnological tools in Plant Pathology. Basic concepts and principles to study host pathogen relationship. Molecular basis of host-pathogen interaction, fungi, bacteria and viruses. Recognition system and signal transduction. Induction of defense responses, pathogenesis related proteins, HR, reactive oxygen species, phytoalexins and systemic acquired resistance. Programmed Cell death. Viral induced gene silencing. Molecular basis of gene-for-gene hypothesis. R-gene expression, transcription profiling, mapping and cloning of resistance genes, marker-aided selection and pyramiding of R genes. Biotechnology and disease management, development of disease resistant plants using genetic engineering approaches. Different methods of gene transfer.

**Advanced Systematic Mycology:** General introduction, historical development and advances in mycology. Recent taxonomic and morphological criteria for classification. Serological, chemical, molecular and numerical taxonomy. Interaction between groups and their Phylogeny. Micro conidiation, conidiogenesis and sporulating structures of fungi imperfecti. Morphology and reproduction of representative plant pathogenic genera. Sexual reproduction in different groups of fungi. Population biology. Pathogenic variability. Heterokaryosis and parasexual cycle. Sex hormones in fungi. Pleomorphism and speciation in fungi. Mechanism of nuclear inheritance. Mechanism of extra-nuclear inheritance. Biodegradation.

**Advanced Plant Virology:** Virus Replication, assembly and architecture of plant viruses. Ultrastructural changes due to virus infection. Variation, mutation and virus strains. Mechanism of virus transmission by vectors, virusvector relationship. Bimodal transmission and taxonomy of vectors and viruses, vector specificity for classes of viruses. Molecular mechanism of vector transmission, symptom expression, viroids and prions. Immunoglobulin structure and functions of various domains. Methods of immunodiagnosis, hybridoma technology, use of monoclonal antibodies. Polymerase Chain Reaction in identification of viruses and their strains. Genome organization, replication, transcription and translational strategies of pararetroviruses and geminiviruses. Satellite viruses and satellite RNA genome organization in tobamo, poty, bromo, cucummo, ilar and tospoviruses. Gene expression and regulation, viral promoters. Molecular mechanism of host virus interactions. Virus induced gene.. Genetic engineering with plant viruses, viral suppressors, a RNAi dynamics, resistant genes. Viruses as potential

vectors. Genetically engineered resistant and transgenic plants. Techniques and application of tissue culture. Origin, evolution and interrelationship with animal viruses.

**Advanced Plant Bacteriology:** Current approaches for the characterization and identification of phytopathogenic bacteria. Ultrastructures and biology of bacteria. Role of enzyme, toxin, exopolysaccharide, polypeptide signals in disease development. Mechanism of wilt (*Ralstonia solanacearum*) development, mechanism of soft rot (*Erwinia* spp.) development, mechanism of crown gall formation (*Agrobacterium tumefaciens*). Host-bacterial pathogen interaction, quorum-sensing phenomenon, Type III secretion system, HR/SR reactions, R genes, Avr-genes, hrp genes, Effector protein. Molecular variability among phytopathogenic prokaryotes and possible host defense mechanism(s). Genetic engineering for management of bacterial plant pathogens, gene silencing and RNAi technology. Epidemiology in relation to bacterial plant pathogens. Development of diagnostic kit. Beneficial prokaryotes. Endophytes, PGPR, phylloplane bacteria and their role in disease management. Endosymbionts for host defence.

**Recommended Books:**

- Baker KF & Snyder WC. 1965. Ecology of Soil-borne Plant Pathogens. John Wiley, New York.
- Roger Hull 2002. Mathew's Plant Virology (4 Ed.). Academic Press, New York
- Mathew J.D. 2003. Molecular Plant Pathology. Bios Scientific Publ., UK.
- Alexopoulos CJ, Mimms CW & Blackwell M. 1996. Introductory Mycology. John Wiley & Sons, New York.
- Dale J.W & Simon P. 2004. Molecular Genetics of Bacteria. John Wiley & Sons, New York.