PROSPECTUS

For Admission to

Master Degree Programme

&

Ph.D. Degree Programme

(2018-19)

Bihar Agricultural University,
Sabour -813 210 (Bhagalpur)

Bihar Agricultural University, Sabour (Bhagalpur) is a State Agricultural University, which has been established on 5th August 2010 by an Act (No. 20 of 2010) State Legislature of Bihar as a State University specified by the UGC under section 22 of the UGC Act. 1956. The area of activity of this University is extended in three Agroclimatic zones spread over in 25 districts that include 12 Research Stations and 20 Krishi Vigyan Kendra (KVKs).

Bihar Agricultural University, Sabour is having following colleges & Institutes.

A. Agriculture Faculty

1. Bihar Agricultural College, Sabour, Bhagalpur.
2. Mandan Bharti Agricultural College, Agwanpur, Saharsa.
3. Veer Kunwar Singh Agricultural College, Dumraon, Buxer.
4. Bhola Paswan Shasrti Agricultural College, Purnea.
5. Dr. Kalam Agriculture College, Kishanganj.

B. Horticulture Faculty

1. Nalanda Horticulture College, Noorsarai, Nalanda.

The University offers courses for the award of Under Graduate, Post Graduate & Ph. D. Degree programme. **The Master's Degree and Ph.d. Degree in Agriculture Faculty is available at BAC, Sabour Campus only**.

This University is situated about 8 km east of Bhagalpur and the nearest railway station is Sabour. Sabour is directly connected by road, rail and air links. The National Highway No. 80 passes through Sabour which links Guwahati (Assam) and Patna (Bihar). The nearest Air Port (Bhagalpur) is located about 4 kms away from the University campus.

MANDATE

The mandate of Bihar Agricultural University, Sabour would include the following objectives:

- To impart education in different disciplines of agriculture and its allied disciplines.
- To undertake strategic and applied research for development of agricultural technology.
- To undertake extension education programme in the State of Bihar, by planning and organizing different programmes of human resource capability in agriculture and related domains.
- To help State Government in production and supply of breeder seeds for multiplication of foundation and certified seeds.

- To serve as a repository of national and international scientific information on various aspects of agricultural and animal production.
- To collaborate with relevant national and international agencies for all round development of agriculture and allied disciplines in the State, in particular and the country as a whole; and also to undertake such other activities, as it may deem fit, from time-to- time.

I. GENERAL INSTRUCTIONS :

1. Admission to the University implies acceptance without any modification by the candidate and his/her parents/guardians of all provisions given in the prospectus or any change in the University rules, regulation, fees, etc. that are made from time to time.
2. The students who have been temporarily dismissed or permanently dropped from this/other University either on account of poor academic performance or on account or act(s) or indiscipline or those who have been debarred from seeking admission in this/other University shall not be eligible to apply for admission to any programme of this University.
3. If any document submitted by the candidate is found to be false at any stage during his/her stay in this University, his/her admission will be cancelled.
4. The informations indicated in this prospectus are only for general guidance and could be modified/changed from time to time by the University without giving any notice.
5. For correspondence regarding admission, contact

REGISTRAR

Bihar Agricultural University, Sabour – 813 210, Bhagalpur
Phone: - 0641 –2452614, Fax:-0641 – 2452614
Website: www.bausabour.ac.in
Email: registrarbau2015@gmail.com

II. IMPORTANT DATES :

A.	Online Application through University Website(www.bausabour.ac.in)	26.04.2018 – 25.05.2018
B.	Downloading of Admit Card from University Website	From 10 to 17.06.2018
C	Date of Examination	17.06.2018 (Sunday)
D	Publication of Result on University Website	05.07.2018
E	Date of Counselling	12.07.2018
F	Classes Start from	16.07.2018

APPLICATION FEE:

	GENERAL / EBC / BC / RCG	SC / ST
FOR MASTER PROGRAMME DEGREE	Rs. 500/-	Rs. 250/-
FOR PH.D. PROGRAMME DEGREE	Rs. 700/-	Rs. 350/-

NOTE: - Application fee in payable on line mode**.** (*Cash, Cheque, Postal orders and money order shall not be accepted).*

1. MASTER DEGREE PROGRAMME

A. ELIGIBILITY REQUIREMENT :

(a) A candidate should possess at least 60% marks in aggregate or 6.0/10.0 in Bachelor's Degree and in the case of SC/ST, 55% marks in aggregate or 5.5/10.0 OGPA.

(b) The Candidate appearing for the Bachelor Degree Examination is also eligible to apply provisionally for admission and appear in the Competitive Test. However, he/she must have final result with required CGPA (Provisional Degree Certificate and Transcript) on or before **the date of Ist counseling.**

(c) Admission to Master Degree Programme is open for **Domicile of Bihar** only./

B. SUBJECT WISE SEATS AND ELIGIBILITY CRITERIA :

Sl. No.	Subjects	BAU Seats	ICAR Seats	Total Seats	Eligibility Criteria
A. Agriculture Faculty					
1.	Agricultural Economics	4	1	5	Bachelor's Degree in Agriculture/ Bachelor's Degree in Horticulture
2.	Agricultural Statistics	3	1	4	
3.	Agronomy	9	3	12	
4.	Biochemistry & Cro Physiology	2	0	2	
5.	Entomology	4	2	6	
6.	Extension Education	4	1	5	
7.	Horticulture (Olericulture)	9	2	11	
8.	Horticulture (Pomology)	9	3	12	
9.	Horticulture (Post Harvest Technology)	3	1	4	
10.	Molecular Biology Biotechnology	4	1	5	
11.	Plant Breeding & Genetics	9	3	12	
12.	Plant Pathology	6	2	8	
13.	Seed Science & Technology	2	0	2	
14.	Soil Science & Agricultural Chemistry	9	3	12	

Category wise distribution of seats:-

SI. No.	Subject	BAU Seats	UR	BC	EBC	RCG	SC	ST	Roaster Point
A. Categories wise seats for M.Sc. (Ag.) Degree Programme.									
1.	Agricultural Economics	4	2	1	-	-	1	-	**28-31**
2.	Agricultural Statistics	3	1	-	1	-	1	-	**32-34**
3.	Agronomy	9	5	1	2	-	1	-	**35-43**
4.	Biochemistry & Crop Physiology	2	1	-	-	-	-	1	**44-45**
5.	Entomology	4	2	1	-	-	1	-	**46-49**
6.	Extension Education	4	2	-	1	1	-	-	**50-53**
7.	Horticulture (Olericulture)	9	4	1	2	-	2	-	**54-92**
8.	Horticulture (Pomology)	9	5	1	2	-	1	-	**63-71**
9.	Horticulture (Post Harvest Technology)	3	1	1	-	-	1	-	**72-74**
10.	Molecular Biology & Biotechnology	4	2	-	1	-	1	-	**75-78**
11.	Plant Breeding & Genetics	9	5	1	1	1	1	-	**79-87**
12.	Plant Pathology	6	3	1	1	-	1	-	**87-93**

13.	Seed Science & Technology	2	1	-	1	-	-	-	**94-95**
14.	Soil Science & Agricultural Chemistry	9	4	1	2	-	2	-	**96-04**
	Total	**77**	**38**	**09**	**14**	**2**	**13**	**1**	**28-04**

Note: - The University reserves the right to make addition or deletion in number of seats without any notice.

SELECTION CRITERIA :

a) Selection will be made on the basis of Competitive Entrance Exam. The candidates will have to opt the subject at the time of counseling on the basis of seat availability and reservation policy of Bihar Government.

b) Merit list shall be prepared on the basis of marks obtained in Competitive Entrance Exam

c) **Cut off marks for** SC/ST candidate is 40% and 45% for all other categories in the merit list of Competitive Entrance Exam.

d) In case of a tie of Marks then their age will determine the priority.

2. PH. D. DEGREE PROGRAMME

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A. ELIGIBILITY REQUIREMENT :

(a) A candidate should possess at least 70% marks in aggregate or 7.0/10.0 in Master's Degree Programme and in case of SC/ST, 65% marks in aggregate or 6.5/10.00 OGPA

(b) The Candidate appearing in the Master Degree Examination is also eligible to apply provisionally for admission and appear in the Competitive Test for admission in Ph. D. Degree Programme. However, he/she must have final result with required CGPA (Provisional Degree Certificate and Transcript) on or before **the date of Ist counseling.**

(c) Admission to Master Degree Programme is open for **all eligible candidates**.

(d) A candidate can apply for admission to only one subject. No change would be allowed thereafter

B. SUBJECT WISE NUMER OF SEATS AND ELIGIBILITY CRITERIA

Sl. No.	Subjects	BAU Seats	ICAR Seats	Total Seats	Eligibility Criteria
A	**Agriculture Faculty**				
1.	Agronomy	3	1	4	M. Sc. (Ag) in Agronomy
2	Agriculture Economics	1	1	2	
3.	Entomology	1	1	2	
4.	Extension Education	1	1	2	M. Sc. (Ag) in Agricultural Extension/ Extension Education
5.	Horticulture (Olericulture)	3	1	4	M. Sc. (Ag) in Olericulture/ Vegetable Sciences/ Horticulture/Horticulture with specialization in Vegetable Sciences/ Horticulture with specialization in Post Harvest Technology
6.	Horticulture (Pomology)	3	1	4	M. Sc. (Ag) in Pomology/ Horticulture/Horticulture with specialization in Fruit Sciences/ Horticulture with specialization in Post Harvest Technology.
7	Plant Breeding Genetics	2	1	3	M. Sc. (Ag) in Agricultural Botany/ Plant Breeding/ Genetics/ Genetics and Plant Breeding/Plant Breeding & Genetics.
8	Plant Pathology	1	1	2	
9	Soil Science Agricultural Chemistry	4	2	6	M. Sc. (Ag) in Soil Sciences/ Agricultural Chemistry/ Agricultural Physics / Soil Microbiology/ Soil Chemistry/ Water Science and Technology/Soil & Water Conservation/Soil Science & Agricultural Chemistry

The University reserves the right to make addition or deletion in number of seats without any notice.

Category wise distribution of seats:-

SI. No.	SUBJECT	Seats	UR	BC	EBC	RCG	SC	ST	Roaster point
A. Categories wise seats for Ph. D Degree (Agriculture Faculty)									
1.	Agronomy	3	1	1	-	-	1	-	**90-92**
2.	Agriculture Economics	1	1	-	-	-	-	-	**93**
3.	Entomology	1	-	-	1	-	-	-	**94**
4.	Extension Education	1	1	-	-	-	-	-	**95**
5.	Horticulture (Olericulture)	3	1	1	-	-	1	-	**96-98**
6.	Horticulture (Pomology)	3	2	-	1	-	-	-	**99-01**
7	Plant Breeding & Genetics	2	1	-	1	-	-	-	**02-03**
8	Plant Pathology	1	-	-	-	-	1	-	**04**
9	Soil Science & Agricultural Chemistry	4	2	1	1	-	-	-	**05-08**
	Grand Total	**19**	**9**	**3**	**4**	**1**	**3**	**0**	**90-08**

C. SELECTION CRITERIA :

a) Selection will be made on the basis of Competitive Entrance Exam. Candidates willing to secure admission in Agriculture (**Code- A1 to A 6**) Faculty will have to appear in Competitive Entrance Test. Counselling and Admission will be allowed in the subject applied for admission on the basis of seat availability and reservation policy of Bihar Government.

b) Merit list shall be prepared on the basis of marks obtained in Competitive Entrance Exam

c) **Cut off marks for** SC/ST candidate is 40% and 45% for all other categories in the merit list of Competitive Entrance Exam.

d) In case of a tie of Marks then their age will determine the priority.

IV. REFUSAL OF ADMISSION :

(a) The Vice-Chancellor reserves the right to refuse the admission of any candidate despite his/her fulfillment of the academic requirements for admission on the basis of Entrance Test-cumAcademic performance, for reasons to be recorded in writing, whose admission in the opinion of the Vice-Chancellor shall not be in the best interest of the University. The decision of the ViceChancellor shall be final.

(b) The students who have been permanently dropped or temporarily dismissed from this/any University either on account of poor academic performance or on account of act of indiscipline or those who have been debarred from seeking admission in this University shall not be allowed to appear in the Competitive Test or will also not be allowed to seek admission as a sponsored candidate. Even if such a candidate has appeared in the competitive Test either by concealing the facts or due to oversight, shall not be eligible for admission.

(c) Candidates found using unfair means in Entrance Competitive Test of this University shall be permanently debarred from appearing in future in the Competitive Test of the University.

(d) It is the responsibility of the candidate to furnish full and correct information on the application form. Any admission made on the basis of wrong or concealed information, supplied by the candidates or due to any oversight or error in the Registrar office and detected subsequent to the admission or joining of the candidate would be cancelled at the cost and risk of the candidate.

V. RESERVATION OF SEATS :

The Category (UR/BC/EBC RCG/SC/ST) declared by the candidate in application form will be final. No subsequent change will be allowed. Reservation of seats shall be given as per Bihar Govt.

VI. INSTRUCTION FOR FILLING THE APPLICATION FORM :

Instructions to the candidates for filling the application form are given in Appendix – I. **(Follow the online instruction to fill up the form)**

VIII. SYLLABUS :

Syllabus for competitive Entrance Examination for admission to Master's Degree Programme is appended in Appendix – II

Syllabus for competitive Entrance Examination for admission to Ph. D. Degree Programme is appended in Appendix – III

IX. SCHEME OF EXAMINATION :

Competitive Entrance Examination will carry 200 multiple chooice questions each of 0.5 marks. The duration of examination will be 2 hours. Candidate have to mark ensure on the OMR Sheet.

X. RESIDENTIAL REQUIREMENT :

A minimum 4 semesters shall be the residential requirement for completing the courses in Master Degree programme and the maximum period in which the regular student must obtain his/her degree shall be 8 semester.

A minimum period of 6 semesters shall be the residential requirement for completing the courses in Ph. D. Degree Programme and the maximum period in which the regular student must obtain his/her degree shall be 12 semesters

It is compulsory for the students to stay in the University/College Hostel. The students may be required to move to other campuses also for one or more semesters for particular courses or research work.

XI. UNIVERSITY FELLOWSHIP :

The University Fellowship shall be awarded as per university rules on the basis of their performance in First Semester result.

XII. COUNSELING :

Candidates called for counseling will be required to submit their relevant documents in original as given below with one set of self-attested photocopies.:-

(a) High School/equivalent examination mark sheet as well as certificate for proof of age.

(b) 10+2/Intermediate Examination certificate and marks sheet.

(c) Bachelor Degree Certificate/ Provisional Degree Certificate and Transcript.

(d) Master Degree Certificate/ Provisional Degree Certificate and Transcript **(e)** Character Certificate from Head of the Institution last attended.

(f) Domicile Certificate issued by the Competent Authority.

(g) Caste certificate issued by the the Competent Authority. (in case candidates claiming reservation).

Counseling does not guarantee admission. It depends on merit and availability of seats in a particular stream/ discipline. In case, candidates fail to attend the counseling his/her candidature shall automatically stand rejected. University shall not bear any responsibility for any postal delay.

XIII. DIRECTIONS FOR CANDIDATE

1. Duplicate Admit card will be issued by the Registrar one day before the date of examination on payment of Rs. 50.00 for which two photographs and proof of application submission have to produce by the candidate himself/herself.
2. The candidate shall be present at the centre 30 minutes before the commencement of the Examination.
3. Candidate will not be admitted to the Examination Hall after 30 minutes from the commencement of the Examination.
4. Candidate who does not produce the Admit Card shall not be allowed to sit in the examination hall by the Centre Superintendent/Invigilator.
5. Candidate must preserve the Admit Card till his/her admission in the institution/Department.
6. Candidates are not allowed to leave the Examination Hall before expiry of the time and handing over the OMR sheet and Question paper (Test Booklet) to the concerned Invigilator.
7. The candidate shall not remove any page(s) from the Test Booklet and if any page(s) is/are found missing from his/her booklet, he/she will be prosecuted against and shall be liable for cancellation of his/her candidature and legal action.
8. The candidate must fill in the Box with **black ballpoint pen** of good quality.
9. Candidates are not allowed to bring any **books, notes or calculator, cell phone** etc. in the Examination Hall.
10. Candidate must follow the instructions strictly as given by the invigilators in the examination hall.
11. No cutting or overwriting is allowed.
12. Impersonation in any form will lead to cancellation of candidature and legal action.

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Appendix – I

Step – I

- Validate your mobile number (This number will be use for all future communication)

Step – II

- Select your domicile state
- Select the program (Master Degree/Ph.D. Degree) your wish to apply
- Select your Category (UR/BC/EBC/RCG/SC/ST)

Step – III

- Fill your peresonal details e in English as per application form.
- Provide your 12 digit AADHAR Number
- Upload soft copy of recent colour photograph
- Fill particulars of academic qualification correctly

Step – IV

- Make payment of application fee through online mode of payment & submit

Appendix – II SYLLABUS FOR COMPETITIVE TEST FOR ADMISSION TO MASTER'S DEGREE PROGREMME

Agriculture Faculty

General Agronomy : National and international agricultural research institutes of India ; Agro-climatic zones of Bihar; Area, production and productivity of major crops in India and Bihar; Weather and climate, micro-climate, weather elements, basics of weather forecasting; Dry land agriculture; Tillage; crops stand establishment; Classification of crops; Definition and concept of cropping system, cropping pattern, multiple cropping, mixed cropping, inter-cropping, multistoried cropping, relay cropping and alley cropping and their importance in relation to food production; Basic elements of crop production; Factors affecting crop production. Irrigation- definition and objectives; Water resources and irrigation development in India and Bihar, Soilplant-water relationships; Methods of soil moisture estimation; Water requirement of crops; Scheduling of irrigation; Methods of irrigation-surface, sprinkler and drip; Irrigation efficiency and water use efficiency; Irrigation water quality and its management; Agricultural drainage; Water management of important crops.

Weeds - introduction, characteristics, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop- weed competition and allelopathy; Concept of weed prevention, control and eradication; Method of weed control - physical, cultural, chemical and biological methods; Integrated weed management; Herbicide: classification, formulations, methods of application; selectivity of herbicides; Weed management in major field and horticultural crops; Aquatic and problematic weeds and their control.

Organic farming - definition, concept, relevance in present context, principles and components; Organic production requirement; Biological intensive nutrient management-organic manures, vermicomposting, green manuring, recycling of organic residues, bio-fertilizers; Soil improvement and amendments; Integrated diseases and pest management-use of bio-control agents, bio-pesticides, pheromones, trap crops; bird perches, Quality considerations, certification, labeling and accreditation processors, marketing, exports. Sustainable agriculture - introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservation of natural resources. Farming system–definition, principles and components; Useful integrated farming system (IFS) models for lowland, upland and dry land situations; Principles of integration of different enterprises for the preparation of farming system modules; Utilization of wasteland through farming system.

Field crops - Origin, economic importance, soil and climatic requirement, varieties and cultural practices of crops –Cereals : rice, maize, sorghum, pearl millet, minor millets, wheat, barley; Pulses**:** pigeon pea, mung bean, urd bean, chickpea, lentil, peas, bean; Oilseeds: ground nut, sesame, soybean, rapeseed and mustard, sunflower, safflower and linseed ; Sugar crop: sugarcane; Medicinal and aromatic crops - mentha, lemon grass, citronella, isabgol and posta ; Commercial crop**:** potato; Forage crops : sorghum, maize, cowpea, cluster bean, napier, berseem and oat; Calculation of seed rate, fertilizers, weedicide and yield estimation; Preparation of cropping scheme for irrigated and dry land situations.

Horticulture: Definition and importance; Classification of horticultural crops; Area and production of different fruit, vegetable and flower crops; Planting systems, high density planting, planning and establishment of new orchard; Principles and methods of training and pruning of fruit crops; propagation methods and use of growth regulators in horticultural crops; Package of practices of important fruits (mango, banana, guava, citrus,

litchi, papaya, strawberry etc.), vegetables (tomato, brinjal, chillies, okra, cucurbitaceous vegetables, cole crops, bulb crops, tuber crops, root crops, beans etc.), ornamental crops (trees, shrubs, climbers, palms and seasonal flowers) and spices (turmeric, coriander, fenugreek, ginger); importance of post-harvest technology in horticultural crops; Maturity indices, harvesting and post-harvest handling of fruits and vegetables; Pre harvest factors affecting quality on post-harvest shelf life of fruits and vegetables; Principles of preservation by heat, low temperature, chemicals and fermentation; Preparation of jams, jellies, preserves, pickles, ketchup, sauce.

Soil Science –Pedological and edaphological concept of soil; Composition of; ear Weathering of rocks and minerals; Soil formation - factors and processes; Type of soil -production importance and their management; Soil physical properties - Soil texture, Textural classes, Particle size analysis, Soil structure : classification, Soil aggregates : significance, Soil consistency, Soil crusting, Bulk density and particle density of soils & porosity : their

Significance and manipulation, Soil compaction, soil colour; Soil moisture – retention and potentials, soil moisture constants, infiltration, percolation, permeability, drainage; Soil temperature, soil air, gaseous exchange, influence of soil temperature and air on plant growth; Soil colloids: properties, nature, types and significance; Layer silicate clays, their genesis and sources of charges, adsorption of ions, ion exchange, CEC & AEC factors influencing ion exchange and its significance; Soil organic matter: composition, decomposability, humus, fractionation of organic matter, carbon cycle, C: N ratio. Soil biology: biomass, soil organisms and their beneficial and harmful roles; Types of soil micro-organism, their role in different geochemical transformations; biological nitrogen fixation, bio-fertilizers, Rhizosphere, Phyllospere, plant-microbe interaction; Microbial pesticides, Microbial composting, Microbial agent to control plant diseases. **Soil health assessment techniques;** Soil as a source of plant nutrients - essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, functions and deficiency symptoms of essential nutrients and measures to overcome deficiency, mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants; Problem soils –acid and salt affected soils : their characteristics, nutrient availabilities, reclamation methods (mechanical, chemical and biological methods); Use of saline water for agriculture; Soil fertility–approaches for soil fertility evaluation and methods; Critical limits of plant nutrients in soil; Factors influencing nutrient use efficiency for different soil and crops grown under rainfed and irrigated condition; Fertilizers and manures - types, application methods; Integrated nutrient management (INM); Bio-fertilizers and their advantage; Preparation of organic manures, vermi compost, FYM, green manuring.

Plant Breeding & Genetics: Major objectives and achievements of plant breeding in India; Centre of diversity and its importance in crop improvement; Modes of reproduction: Sexual, Asexual; Modes of pollination; genetic consequences, differences between self and cross pollinated crops; Nature of Pollination of crops; Parthenocarpy in plants; Germplasm conservation and its utilization; Concept of gene and gene pool; Hybridization & methods of handling segregating generations; Pure line selection, Mass selection, Heterosis breeding, Hybridization, pedigree method, bulk method, modified bulk method, back cross method, recurrent selection; Male sterility and self–incompatibility-mechanism and their utilization in crop improvement; Heterosis –concepts, estimation and genetic basis of heterosis; Clonal selection; Polyploidy breeding and its importance in crop breeding; Mutation breeding; Hybrid production and importance in different crop plants; Wide hybridization and constrains related to it; Synthetics and composites, their development; Crop ideotype-concept and importance, IPR and its related issues, Genetic basis of adaptability to unfavorable environments; Definition of biometrics, assessment of variability i.e., additive, dominance and epistasis and their differentiation; Genotype X Environment interaction and influence on yield performance. Hardy-Weinberg Law; Study in respect of origin, distribution of species, wild relative and forms of Vegetables (Tomato, bhindi,

chilli, cucumbers); Flowers corps (Chrysanthemum, rose, galardia, gerbera & marigold); fruit crops (aonla, guava, mango, custard apple, banana, papaya);; Breeding for resistance to biotic and abiotic stresses variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pest; Quantitative and qualitative characters; Components of genetic variation, correlation and regression; Cell division-mitosis and meiosis; Mendel's laws of inheritancetions, Multiplealleles, linkageand crossingtheirover; except Cytoplasmic inheritance, Chromosome: structure, morphology, number and types. Structure of DNA and RNA and its replication; Concept of Plant Biotechnology: Tissue Culture and Plant Genetic Engineering; Tot potency in plant, meristem culture, anther culture, pollen culture, embryo culture, callus culture, cell culture; Somaclonal variation; Transgenic- achievements and future prospects.

Seed Science : Basic principles of seed production, kinds of seed and Indian Seed Act 1966; ntroduction and history of seed industry in India; Definition of seed; Differences between grain and seed; Importance and scope of vegetable seed production in India; Principles of vegetable seed production; Role of temperature, humidity and light in vegetable seed production; Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous and exotic vegetables; Seed germination and purity analysis; Field and seed standards; Seed drying and extraction.

Plant Physiology: Transpiration: significance, Transpiration in relation to crops productivity, Water Use Efficiency, WUE in C3, C4 and CAM plants, Factors affecting WUE; Photosynthesis, Significance of C3, C4 and CAM pathway, Relationship of Photosynthesis and crop productivity, Translocation of assimilates, Phloem loading, apoplastic and symplastic transport of assimilates, Source and sink concept, Photorespiration, Factors affecting photosynthesis and productivity, Methods of measuring photosynthesis, Photosynthetic efficiency, Dry matter partitioning, Harvest index of crops; Respiration and its significance, Brief account of Growth respiration and maintenance respiration, Hydroponics, Introduction of Photo-periodism and Vernalization in relation to crop productivity; Photo-periodism, Plant Growth Regulators – Occurrence –Biosynthesis –Mode of action of Auxins, Gibberellins, Cytokinin, ABA, Ethylene, Novel plant growth regulators, Commercial application of plant growth regulators in Agriculture, Senescence and abscission.

Entomology : Economic importance of insects; General morphology and anatomy of insect; Classification of insects; Apiculture, sericulture and lac culture; Important insect and non-insect pests of important field crops (rice, maize, sorghum, pearl millet, minor millets, wheat, barley; pigeon pea, mung bean, urd bean, chickpea, lentil, peas, bean, ground nut, sesame, soybean, rapeseed and mustard, sunflower, safflower and linseed sugarcane); vegetables (tomato, brinjal, chillies, okra, cucurbitaceous vegetables, cole crops, bulb crops, tuber crops, root crops, beans), orchard and plantation crops (mango, banana, guava, citrus, litchi, papaya, palms) and their management; Storage pests and their management; Integrated pest management; Biological control of pests; Plant quarantine measures; Different categories of pesticides, their formulation and modes of action; Insect toxicology and concept of LD_{50}/LC $_{50}$MRL and waiting period; Recent techniques of pest management; Plant protection equipment'sanditsapplication in pest management; Insecticide Act, 1968 & Puts, 1971. General characteristics of plant pathogenic nematodes, its morphology and biology; Classification of nematodes up to family level with emphasis on groups containing economically important genera; General symptoms caused by nematodes and their management.

Plant Pathology : Introduction of important plant pathogenic organisms - fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroid, algae, Protozoa and phanerogamic parasites with

examples of diseases caused by them; Prokaryotes: classification of prokaryotes according to Bergey's; General characters, Manual of reproduction and classification of fungi; Definition and objectives of Plant Pathology; Survival and

Dispersal of Plant Pathogens; Plant disease epidemiology; General principles of plant diseases management; Integrated plant disease management (IPDM); Economic importance, symptoms, cause, epidemiology and disease cycle and important diseases of important field crops (rice, maize, sorghum, pearl millet, minor millets, wheat, barley; pigeon pea, mung bean, urd bean, chickpea, lentil, peas, bean, ground nut, sesame, soybean, rapeseed and mustard, sunflower, safflower and linseed sugarcane); vegetables (tomato, brinjal, chillies, okra, cucurbitaceous vegetables, cole crops, bulb crops, tuber crops, root crops, beans), orchard and plantation crops (mango, banana, guava, citrus, litchi, papaya, palms) and their management.

Agricultural Economics –meaning, definition; Basic Concepts: Goods, Service, Utility, Value, Price, Wealth, Welfare; Wants: Meaning, characteristics, classification, importance; Law of Diminishing Marginal Utility, law of equi-marginal utility; Consumer equilibrium; Demand: meaning, definition , kinds of demand, demand schedule, demand curve, market demand, Price, income and cross elasticities; Public Finance–Meaning, Principle, Sources, Direct Tax, Indirect Tax; Public expenditure; Inflation; Nationalized and Commercial Banking System. Agricultural credit; Agricultural co-operative: structure and function; Agricultural marketing - definition, classification; Marketable surplus & marketed surplus, Marketing channel, Types and systems of farming, Farm planning and budgeting, Risk and Uncertainty; Principles of production and costs, Cost of cultivation, net returns, Farm records, Balance sheet, Profit –loss analysis.

Extension Education: meaning, definition; Agricultural extension & its importance; Rural development: meaning, definition, objectives and importance; Different extension programmes - Etawah Pilot Project, Community Development Programme, Panchayati Raj System, High Yielding Variety Programme, National Demonstration, Frontline Demonstration, Krishi Vigyan Kendra, ATMA, Institutional Village Linkage Programme (IVLP), Integrated RuralDevelopment Programme (IRDP); Communication: meaning, definition, elements and selected models; Extension Programme-planning : meaning, scope, principles and steps; Monitoring and evaluation of Extension programme; Extension teaching methods; Leadership, Attitude, Knowledge, Skill, Training, Communication skill; Local leaders, Adoption and Diffusion, Innovations and their characteristics, Kisan Call Centers, Entrepreneurship in Agriculture, SWOT analysis; Capacity building of extension personal.

Agricultural Statistics : Definition of statistics , its use and limitation; Graphical representation - Histogram, Frequency polygon, Frequency curve, Ogive; Measures of Central Tendency – Mean, Median, Mode, Geometric Mean, Harmonic Mean; Measures of Dispersion –Range, Quartile deviation, Mean deviation, Standard deviation, Variance, Coefficient of Variation; Concept of Probability; Simple Random Sampling; Standard Error, Type I and Type II Error; Null Hypothesis, Level of Significance; Test of Significance based on Chi-Square, t and F test; Correlation Coefficient , Regression Coefficient, Experimental Designs –CRD, RBD and LSD.

Agricultural Engineering: Basic concepts of various forms of energy; unit and dimensions of force, energy and power; IC Energies: Basic principles of operation of compression, ignition and spark ignition engines, two strokes and four stroke energies; cooling and lubrication system, power transmission system, broad understanding of performance and efficiency of tractors, power tillers and their types and uses; Tillage: objectives, methods of ploughing; Primary tillage implements: construction and function of mould board ploughs, disc and rotary ploughs; Secondary tillage implements: constructions and function of tillers, harrows,

levelers, ridges and bund formers; Sowing and transplanting equipment: seed drills, potato planters, seedling transplanter; Grafting, pruning and training tools and equipments; Inter-cultural equipments: sweep. Junior hoe, weeders, long handle weeders.

Appendix – III

SYLLABUS FOR COMPETITIVE TEST FOR ADMISSION TO Ph. D. DEGREE PROGRAMME

AGRICULTURAL ECONOMICS

1. AG ECON 501 MICRO ECONOMIC THEORY AND APPLICATIONS (2+0)

Theory of Consumer Behaviour - Cardinal Utility Approach - Ordinal Utility Approach – Income effect and substitution effect – Applications of Indifference curve approach - Revealed Preference Hypothesis – Consumer surplus - Derivation of Demand curve – Elasticity of demand. Theory of Production - Production functions – Returns to scale and economies of scale – Technical progress – Theory of Costs – Cost curves– Profit maximization and cost minimization – Derivation of supply curve – Law of Supply – Producers' surplus. Market Equilibrium - Behaviour of Firms in Competitive Markets – Perfect Competition- Effect of Taxation and Subsidies on market equilibrium - Monopoly-
Monopolistic - Oligopoly- Theory of Factor Markets. General Equilibrium Theory - Welfare Economics - Pareto Optimality – Social welfare criteria - Social Welfare functions.

2. AG ECON 502 MACRO ECONOMICS AND POLICY (2+0)

Nature and Scope of Macro Economics - Methodology and Keynesian Concepts National Income - Concepts and measurement- Classical theory of Employment and Say's Law-Modern theory of Employment and Effective Demand. Consumption function- Investment and savings - Concept of Multiplier and Accelerator - Output and Employment - Rate of interest - Classical, Neo classical and Keynesian version- Classical theory Vs Keynesian theory – Unemployment and Full employment. Money and classical theories of Money and Price - Keynesian theory of money and Friedman Restatement theory of money - Supply of Money - Demand for Money -Inflation: Nature, Effects and control. IS & LM frame work - General Equilibrium of product and money markets - Monetary policy - Fiscal policy- Effectiveness of Monetary and Fiscal policy - Central banking. Business cycles - Balance of Payment - Foreign Exchange Rate determination.

3. AG ECON 504 AGRICULTURAL PRODUCTION ECONOMICS (1+1)

Nature, scope and significance of agricultural production economics- Agricultural Production processes, character and dimensions-spatial, temporal - Centrality of production functions, assumptions of production functions, commonly used forms - Properties, limitations, specification, estimation and interpretation of commonly used production functions. Factors of production, classification, interdependence, and factor substitution - Determination of optimal levels of production and factor application –Optimal factor combination and least cost combination of production - Theory of product choice; selection of optimal product combination. Cost functions and cost curves, components, and cost minimization –Duality theory – cost and production functions and its applications -Derivation of firm's input demand and output supply functions -Economies and diseconomies of scale. Technology in agricultural production, nature and effects and measurement - Measuring efficiency in agricultural production; technical, allocative and economic efficiencies - Yield gap analysis-concepts-types and measurement - Nature and sources of risk, modeling and coping strategies.

4. AG ECON 505 AGRICULTURAL MARKETING AND PRICE ANALYSIS 2+1

Review of Concepts in Agricultural Marketing - Characteristic of Agricultural product and Production – Problems in Agricultural Marketing from Demand and Supply and Institutions sides. Market intermediaries and their role - Need for regulation in the present context - Marketable & Marketed surplus estimation. Marketing Efficiency - Structure Conduct and Performance analysis - Vertical and Horizontal integration - Integration over space, time and form-Vertical coordination. Marketing Co-operatives – APMC Regulated

Markets - Direct marketing, Contract farming and Retailing - Supply Chain Management - State trading, Warehousing and other Government agencies -Performance and Strategies – Market infrastructure needs, performance and Government role - Value Chain Finance. Role of Information Technology and telecommunication in marketing of agricultural commodities - Market research-Market information service - electronic auctions (e-bay), e-Chaupals, Agmarket and Domestic and Export market Intelligence Cell (DEMIC) – Market extension. Spatial and temporal price relationship – price forecasting – time series analysis – time series models – spectral analysis. Price policy and economic development – non-price instruments. Theory of storage - Introduction to Commodities markets and future trading - Basics of commodity futures - Operation Mechanism of Commodity markets – Price discovery - Hedging and Basis - Fundamental analysis - Technical Analysis - Role of Government in promoting commodity trading and regulatory measures. WTO & its impact on Indian agriculture.

5. AG ECON 509 AGRICULTURAL FINANCE AND PROJECT MANAGEMENT 2+1

Role and Importance of Agricultural Finance. Financial Institutions and credit flow to rural/priority sector. Agricultural lending – Direct and Indirect Financing - Financing through Co-operatives, NABARD and Commercial Banks and RRBs. District Credit Plan and lending to agriculture/priority sector. Micro-Financing and Role of MFI's - NGO's, and SHG's. Lending to farmers – The concept of 3 C's, 7 P's and 3 R's of credit. Estimation of Technical feasibility, Economic viability and repaying capacity of borrowers and appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions – credit widening and credit deepening. Financial Decisions – Investment, Financing, Liquidity and Solvency. Preparation of financial statements - Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and Assessing the performance of farm/firm. Project Approach in financing agriculture. Financial, economic and environmental appraisal of investment projects. Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal techniques – Undiscounted measures. Time value of money – Use of discounted measures - B-C ratio, NPV and IRR. Agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects. Net work Techniques – PERT and CPM. Risks in financing agriculture. Risk management strategies and coping mechanism. Crop Insurance programmes – review of different crop insurance schemes – yield loss and weather based insurance and their applications.

AGRONOMY

UNIT – I

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; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield. Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress. Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture; crop residue recycling and management, sustainable agriculture and good agricultural practices.

UNIT – II

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions. Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients. Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions. Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermin compost and residue wastes in crops.

UNIT - III

Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices. Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides. Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation. Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control. Integrated weed management; cost: benefit analysis of weed management.

UNIT - IV

Water and its role in plants; water resources of India and Bihar, major irrigation projects of India and Bihar, extent of area and crops irrigated in India and different states. Irrigation and irrigation management-definition, objectives and limitations. Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. water requirement of crops. Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; micro irrigation system; fertigation; management of water in controlled environments and poly houses. Concept of of ET, CU, PET, ETc, Epan, and their importance in assessing WR, IW/ CPE ratio and its importance. Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; leaching requirement , irrigation efficiencies and methods of increasing field water efficiency, Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops , drainage coefficient and methods of field drainage, their layout and spacing.

EXTENSION EDUCATION

UNIT- I

Approaches of Agricultural Extension: A critical analysis of different approaches of agricultural extension. Importance and relevance of indigenous knowledge system, identification and documentation of ITK, Integration of ITK system in research formulation, Concept of Agricultural Knowledge and Information System, Training of Stakeholders of AKIS. Cyber Extension - Concept of cyber extension, national and international cases of extension projects using ICT and their impact of agricultural extension, alternative methods of financing agricultural extension - Scope, limitations and experience and cases. Research - Extension -Farmer - Market linkage: Importance, Scope, Implications etc., Market - Led Extension, Farmer - Led Extension, Concept of Farm Field School, Farm School, Public - Private Partnership: Meaning, Models, Identification of various areas for partnership. Stakeholder's analysis in Extension.Main streaming gender in Extension - Issues and Prospects. Implications of WTO - AOA for extension services, re-orientation of extension services for agri-business and marketing activities, GOI-NGO collaboration to improve efficiency of extension. Extension and contemporary issues: Extension and issues related to rural poverty. Privatization of Extension. Intellectual Property Rights (IPRs). Extension Reforms in India - Decentralized decision making, Bottom up planning, Farming System and Situation based Extension Delivery System, Extension delivery through Commodity Interest Groups.

Organization innovations in Extension - ATIC, IVLP, Kisan Call Centres.

UNIT- II

Scaling technique - meaning, types, principles, steps and quality, techniques of attitude scale construction - Paired comparison, Equal appearing intervals, Successive Intervals, Summated ratings, Scalogram analysis, Scale discrimination technique, Reliability and Validity of Scales. Sociometrics, content analysis, case studies, Q-sort techniques, Semantic different technique. Projective and Semi projective techniques, Critical incident techniques, Computer packages for analysis - usage in Extension Research. Knowledge scale measurement. Participatory tools and techniques in behaviour Research - Data collection and Evaluation. Impact analysis, e-data collection and information analysis.

UNIT- III

Paradigm shift in training - learning scenario, Training Approaches - Experiential learning - laboratory - organization development (system) approaches; Training Design, Designing an effective training programme, Harmonizing training needs, Course Objective, content and methods. Designing an effective training session - the semantics involved, Designing experiential training sessions, simulation exercises, and openness in training transaction - managing dilemmas, ambivalence and conflicts and confusion (for both trainers and trainees).Recent Training Techniques for understanding and facilitation team building, group dynamics, motivation and empowerment, laboratory methods: micro-lab process work, and sensitivity training, Psychological instruments as training tools: TAT, Inventories, Cases, etc. Participatory Training Techniques - Lecture, Brainstorming, Group discussion and Training Games. Role Play, Psycho-drama, Coaching, Counseling, etc., Trainer's roles and dilemmas, Factors Effecting Training Effectiveness and Training Evaluation.

UNIT- IV

Introduction to organizations: Concept and Characteristics of organizations, Organizational Behvaiour Context and concept - levels of organizations - formal and informal organizations, Theories of organizations:

Nature of organizational theory - classical theories - features of Bureaucracy - administrative theory and Scientific management - Neo-classical theories - the human relations movement - modern theory. Systems approach to study organization needs and motives - Attitude, values and ethical behaviour - alienation and work - work motivation - communication and interpersonal behaviour - organization communication - leadership behaviour -decision making, problem solving techniques - organizational climate - change proneness and resistance to change, Organizational change, Organizational structure - Process in organizing - Dimension of Motivation Climate. Departmentation - Span of Management - Delegation of authority – Centralizationand decentralization - line and staff organization - functional organizationdivisonalisation - Project organization - Matrix organization - free form organization - top management structure. Individual behaviour in organization. Fundamentals of Human relations and Organizational behaviour, Groups and teams - Organisational culture and performance. Dynamics of Organization behaviour - leadership conflict situationsand inter group behavior- Organisational Development - Factors effecting organization effectiveness. Creativity, leadership, motivation and organization development.

UNIT- V

Concepts in Instructional Technology, Scope of Instructional Technology. History of agricultural education in India. Guidelines for curriculum development in Agricultural Universities. Curriculum design development.

Course outline, Lesson plans for theory and practicals. Teaching and learning styles. Theories of learning. Cognitive levels. Instructional Course Objective. Motivation of students. Instructional Methods. Experiential learning cycle. Innovative Instructional Aids.Computer Assisted Instruction. Programmed instruction technique. Team Teaching. E-Learning, Art of Effective Communication. Distance education. Student evaluation - Question Bank. Appraisal of Teacher Performance. Review of research in Instructional Technology.

Introduction to organizations: Concept and Characteristics of organizations, Organizational Behvaiour- Context and concept - levels of organizations - formal and informal organizations, Theories of organizations: Nature of organizational theory - classical theories - features of Bureaucracy - administrative theory and Scientific management - Neo-classical theories - the human relations movement - modern theory. Systems approach to study organization needs and motives - Attitude, values and ethical behaviour - alienation and work - work motivation - communication and interpersonal behaviour - organization communication - leadership behaviour -decision making, problem solving techniques - organizational climate - change proneness and resistance to change, Organizational change, Organizational structure - Process in organizing - Dimension of Motivation Climate. Departmentation - Span of Management - Delegation of authority – Centralizationand decentralization- line and staff organization - functional organizationdivisonalisation- Project organization- Matrix organization-free formorganization - top management structure. Individual behaviour in organization. Fundamentals of Human relations andOrganizational behaviour,

Groups and teams - Organisational culture and performance. Dynamics of Organization behaviour - leadership conflict situationsand inter group behavior- Organisational Development - Factors effecting organization effectiveness. Creativity, leadership, motivation and organization development.

UNIT - I

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 cool season vegetables: Potato, cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels, sprout, Root crops: carrot, radish, turnip, beetroot, Bulb, onion, garlic, Peas, broad bean, green leafy vegetables.

UNIT – II

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 economics of crop production and seed production of Warm Season Vegetables: Tomato, Eggplant, Hot and Sweet Peppers, Okra, Beans, Cowpea and Cluster Bean, Cucurbitaceous Crops, Tapioca and Sweet Potato, Green Leafy vegetables.

UNIT – III

Classification of vegetables, Principles of breeding of vegetable crops; Heterosis, mutation breeding, polyploidy, male sterility system, self incompatibility: mechanisms favoring self and cross pollination; origin, botany, taxonomy, floral biology, cytogenetics, genetics, breeding objectives; Various 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 the crops *viz*. Potato, Tomato, Eggplant, Hot Pepper, Sweet Pepper, Okra, Peas & Beans, Amaranth, Chenopods, Lettuce, Gourds, Melons, Pumpkins & Squashes, Cabbage, Cauliflower, Carrot, Beetroot, Radish, Sweet Potato and Tapioca.

UNIT – IV

Cellular structures and their functions; definition of growth and development, growth analysis and its importance in vegetable production; Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins, ethylene and abscissic acid; Application of synthetic hormones, plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants 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; 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.

UNIT – V

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India. 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; Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control; 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 and vegetatively propagated vegetable crops.

HORTICULTURE (POMOLOGY)

UNIT – I

Area, production and productivity, nutritional values, commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, critical satges of water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, honeybees in cross pollination, physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones(AEZ) and industrial supports. Intellectual property rights, regulatory horticulture. Detection of genetic. Constitution of germplasm and maintenance of core group. Origin and distribution, taxonomical status - species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems, breeding objectives, ideotypes, approaches for crop improvement - introduction, selection, hybridization, mutation breeding, polyploidy breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological interventions, achievements and future thrust in the following selected fruit crops.

Mango, banana, citrus, papaya, guava, sapota, jackfruit, pineapple, annonas, avocado, aonla, pomegranate, phalsa, ber, apple, pear, quince, grapes, Plums, peach, apricot, cherries, hazelnut Litchi, loquat, persimmon, kiwifruit, strawberry, Nuts- walnut, almond, pistachio, pecan, Minor fruits- mangosteen, carambola, bael, wood apple, fig, jamun, rambutan, pomegranate, custard apple, carambola, and Plantation crops-coconut, arecanut, tea, coffee and cocoa.

UNIT – II

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixis, polyembryony, chimeras, Bud sport. Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth. Seed quality, treatment, packing, storage, certification, testing. Asexual propagation – rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hotbeds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods. Budding and grafting – selection of elite mother plants, methods. Establishment of bud wood bank, stock, scion and inter stock, relationship –Graft Incompatibility. Rejuvenation through top working – Progeny orchard and scion bank. Micro-propagation – principles and concepts, commercial exploitation in horticultural crops. Techniques - *in vitro* clonal propagation, direct organogenesis,

embryogenesis, micrografting, meristem culture. Hardening, packing and transport of micro-propagules. Physiological disorder of national importance.

UNIT – III

Growth and development- definition, parameters of growth and development, growth dynamics, morphogenesis.

Annual, semi-perennial and perennial horticultural crops, environmental impact on growth and development, effect of light, photosynthesis and photoperiodismernalisation, teffect of temperature, heat units, thermoperiodism. Assimilate partitioning during growth and development, influence of water and mineral nutrition during growth and development, biosynthesis of auxins, gibberellins, cytokinins, abscissic acid, ethylene, brasssinosteroids, growth inhibitors, morphactins, role of plant growth promoters and inhibitors. Developmental physiology and biochemistry during dormancy, bud break, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization and fruit set, fruit drop, fruit growth, ripening and seed development. Growth and developmental process during stress - manipulation of growth and development, impact of pruning and training, chemical manipulations in horticultural crops, molecular and genetic approaches in plant growth development. Analytical technique in horticulture research.

PLANT BREEDING & GENETICS

UNIT I

Cell- structure and its type; Mendel's laws; Chromosomal theory of inheritance.; Multiple alleles, Gene interactions, Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkagedetection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance; Population - Mendelian population – Random mating population -Frequencies of genes and genotypes Hardy-Weinberg equilibrium; Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis; Genetic fine structure analysis, Allelic complementation, Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters; Regulation of gene activity in prokaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression. Gene regulation in eukaryotes, RNA editing; Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs);Genomics and proteomics; Functional and pharmacogenomics; Metagenomics; Methods of studying polymorphism at biochemical and DNA level; Transgenic bacteria and bioethics; Gene silencing; genetics of mitochondria and chloroplasts; Concepts of Eugenics, Epigenetics, Genetic disorders and Behavioural genetics; Architecture of chromosome in prokaryotes and eukaryotes; Artificial chromosome construction and its uses; Special types of chromosomes; Cell Cycle and cell division; synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over and recombination models, cytological basis, Structural and numerical variation in chromosomal number and its Evolutionary significance, Introduction to techniques for karyotyping; Chromosome banding and painting - *in situ* hybridization and various applications; euploidy - haploids, diploids and polyploids ; Utilization of aneuploids in gene location, somatic segregation and chimeras – endomitosis and somatic reduction ; balanced lethals and chromosome complexes; Inter-varietal chromosome substitutions; Polyploidy and role of polyploids in crop breeding; Evolutionary advantages of autopolyploids vs allopolyploids –- Role of aneuploids in basic

and applied aspects of crop breeding, Alien addition and substitution lines; Apomixis - Evolutionary and genetic problems in crops with apomixes; Reversion of autopolyploids to diploids; Genome mapping in polyploids - Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, triticale and brassica) – Hybrids between species with same chromosome number, alien translocations - Hybrids between species with different chromosome number; Gene transfer using amphidiploids – Bridge species; Fertilization barriers in crop plants at pre-and post fertilization levels- *In vitro* techniques to overcome the fertilization barriers in crops; Chromosome manipulations in wide hybridization ; case studies – Production and use of haploids, dihaploids and doubled haploids in genetics and breeding.

UNIT II

Ultrastructure of the cell; Differences between eukaryotic and prokaryotic cells, macromolecules; Structure and function of cell wall, nuclear membrane and plasma membrane; Cellular Organelles ;Bioenergetics; Ultrastructure and function; Chloroplast and other photosynthetic organelles; Interphase nucleus- Structure and chemical composition; Cell division and physiology of cell division; Historical background of molecular genetics; Genetic material in organisms; Structure and properties of nucleic acid, DNA transcription and its regulation, Genetic code, regulation of protein synthesis in prokaryotes and eukaryotes – ribosomes, t-RNAs and translational factors; Transposable elements; Mechanisms of recombination in prokaryote; DNA organization in eukaryotic chromosomes – DNA content variation; Gene amplification and its significance; Proteomics and protein-protein interaction; Signal transduction; Genes in development; Cancer and cell aging; Biotechnology and its relevance in agriculture ;Tissue culture- History, callus, suspension cultures, cloning; Regeneration; Somatic embryogenesis; Anther culture; somatic hybridization techniques; Meristem, ovary and embryo culture; cryopreservation; Techniques of DNA isolation, quantification and analysis; Genotyping; Sequencing techniques; Vectors, vector preparation and cloning, Biochemical and Molecular markers, mapping populations ;Molecular mapping and tagging of agronomically important traits. Statistical tools in marker analysis, Robotics; Marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants, Gene Pyramiding; Genomics and genoinformatics for crop improvement; Marker-assisted backcross breeding for rapid introgression, Generation of EDVs; Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, physical methods of gene transfer. Production of transgenic plants in various field crops & commercial release; Biotechnology applications in male sterility/hybrid breeding, molecular farming; MOs and related issues; GMO; International regulations, biosafety issues of GMOs; Intellectual property rights; Nanotechnology and its applications in crop improvement programmes.

UNIT III

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding; Centres of Origin-biodiversity and its significance; Genetic basis of breeding self- and cross - pollinated crops including mating systems and response to selection, Plant introduction and role of plant genetic resources in plant breeding; Self-incompatibility and male sterility in crop plants and their commercial exploitation; Pure line theory, pure line selection and mass selection methods; pedigree, bulk, backcross, single seed descent and multiline method; Population breeding in self-pollinated crops (diallel selective mating approach);Breeding methods in cross pollinated crops; progeny selection schemes, recurrent selection schemes for intra and interpopulation improvement and development of synthetics and composites; Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their

parent varieties/inbred; Breeding methods in asexually/clonally propagated crops; Concept of plant ideotype and its role in crop improvement; Transgressive breeding; Mutation breeding its nature and its classification; Breeding for abiotic and biotic stresses; Cultivar development- testing, release and notification, maintenance breeding,

Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights; Mendelian traits *vs* polygenic traits - its inheritance - Multiple factor hypothesis; Variations associated with polygenic traits; Nature of gene action; Principles of Analysis of Variance (ANOVA) - Expected variance components, random and fixed models; MANOVA, biplot analysis; Designs for plant breeding experiments – principles and applications; Genetic diversity analysis –Association analysis; Path analysis and Parent - progeny regression analysis; Discriminant function and principal component analyses; Selection indices - selection of parents; Simultaneous selection models- concepts of selection - heritability and genetic advance; Generation mean analysis; Mating designs- Diallel, partial diallel, line x tester analysis, NCDs and TTC; Concepts of combining ability and gene action; Analysis of genotype x environment interaction; Models for GxE analysis and stability parameters; AMMI analysis – principles and interpretation; QTL mapping in Genetic analysis; Marker assisted selection (MAS) in Plant breeding and factors influencing MAS.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

UNIT – I

Soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence; dispersion and workability of soils; Soil structure - genesis, types and management soil structure; soil aggregation, and stability; soil tilth, characteristics of good soil tilth; Soil water: potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential.

Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability; measurement of hydraulic conductivity in saturated and unsaturated soils. Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum. Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management. Energy balance; thermal properties of soil; measurement of soil temperature. Soil Consistency, Atterbergs' limits and its practical significance, Plasticity ; Soil crusting : types, measurement and management. Soil erosion: Wind and water erosion, factors, types . Soil conservation measures Watershed : concepts and its implication in modern context Water Use Efficiency: Concept

UNIT – II

Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms. Nutrient interactions and plant growth. Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; fertilizer use efficiency. Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions. Potassium - forms, equilibrium in soils and its agricultural significance; potassium fixation; management of potassium fertilizers under field conditions. Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium– factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers. Micronutrients – critical limits in soils and plants;

factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendations; quantity– intensity relationships; soil test crop response correlations and response functions. Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; integrated nutrient management. Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Fertlizer control order (FCO), Specifications, Methods of fertilizers and manures analysis, Fertilizer dose calculation.

UNIT – III

Composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter, clay-organic interactions. Ion exchange processes in soil; cataion exchange- theories based on law of mass action, adsorption isotherms, donnan-membrane equilibrium concept, claymembrane electrodes and ionic activity measurement, Schofields' ratio law and its implication in plant nutrition ; Suspension effect. Thermodynamics, statistical mechanics; anion and ligand exchange, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; Problem soils

(Acid Soils, Acid sulphate soils, Saline soils, Saline alkali SOils, Alkali soils etc), their characteristics and their management strategies. Chemistry of acid soils; active and potential acidity; lime potential, salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments, submerged soils. uality of irrigation water, different parameters and its measurement. D value and its practical implication.

UNIT – IV

Crystallography, space lattice, coordination theory, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals. Rocks and minerals : origin, Classification and its implication in soil genesis. Factors of soil formation, soil forming processes; weathering of rocks and mineral; soil profile; weathering sequences of minerals. Concept of soil individual; soil classification systems - soil survey and its types; soil survey techniques - conventional and modern; soil series – characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; soil mapping, thematic soil maps. Landform – soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT) – concept and application.

UNIT – V

Soil microbial ecology, types of organisms in different soils; biochemistry of root-soil interface; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora. Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation; cycles of important organic nutrients. Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil. Preparation and preservation of

farmyard manure, animal manures, rural and urban composts and vermicompost. Biofertilizers – definition, classification, specifications, method of production and role in crop production. Concept of Soil Quality and Soil health. Soil Quality assessment techniques. Biological degradation of soils and its implication in crop production

UNIT – VI

Soil, water and air pollution problems. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc. Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as a sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms. Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases – carbon dioxide, methane and nitrous oxide. Carbon sequestration-Concepts, approaches and potential Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution. Soil degradation: types, Physical, Chemical and Biological, factors of degradation, management option.

ENTOMOLOGY

COURSE CONTENTS

ENT 501 INSECT MORPHOLOGY **1+1 Theory**

UNIT I

Principles, utility and relevance: insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.

UNIT II

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

UNIT III

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.

UNIT IV

Abdomen- Segmentation and appendages; Genitalia and their modifications; Embryonic and post-embryonic development; Types of metamorphosis. Insect sense organs (mechano-, photo- and chemo-receptors).

ENT 502 INSECT ANATOMY, PHYSIOLOGY AND NUTRITION **2+1 Theory**

UNIT I

Scope and importance of insect anatomy and physiology.

UNIT II

Structure, modification and physiology of different systems- digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands.

UNIT III

Thermodynamics; physiology of integument, moulting; growth, metamorphosis and diapause.

UNIT IV

Insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular micro-organisms and their role in physiology; artificial diets.

ENT 504 CLASSIFICATION OF INSECTS **2+1 Theory**

UNIT I

Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda – Classes – Ellipura (Collembola, Protura), Diplura and Insecta- Orders contained.

UNIT II

Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them. Collembola, Protura, Diplura. Class Insecta: Subclass Apterygota – Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera – Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera: Plecoptera, Blattodea,

Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.

UNIT III

Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them (Continued). Division Neoptera – Subdivision Endopterygota, Section Neuropteroid-Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpoid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

ENT 505 INSECT ECOLOGY **1+1 Theory**

UNIT I

History and Definition. Basic Concepts. Organisation of the Biological world. Plato's 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. Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, and biocoenosis, Systems approach to ecology.

UNIT II

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, Environmental Resistance and Optimal yield. Vital Statistics- Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables. Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) - aestivation, hibernation.

UNIT III

Biotic factors- Food as a limiting factor for distribution and abundance, Nutritional Ecology. Food chain- web and ecological succession. 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. Prey-predator interactions- Basic model- Lotka-Volterra Model, Volterra's principle. Functional and numerical response. Defense mechanisms against predators/parasitoids- Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies.

UNIT IV

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 Przibram'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

ENT 507 BIOLOGICAL CONTROL OF CROP PESTS AND WEEDS 1+1 Theory

UNIT I

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation.

UNIT II

Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects.

UNIT III

Mass production of quality biocontrol agents- techniques, formulations, economics, field release/application and evaluation.

UNIT IV

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.

ENT 508 TOXICOLOGY OF INSECTICIDES 2+1 Theory

UNIT I

Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India.

UNIT II

Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature. Structure and mode of action of organo-chlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials, botanicals, new promising compounds, etc.

UNIT III

Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides-synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity.

UNIT IV

Insecticide metabolism; pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence.

UNIT V

Insecticide residues, their significance and environmental implications. Insecticide Act, registration and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

ENT 510 PRINCIPLES OF INTEGRATED PEST MANAGEMENT 1+1 Theory

UNIT I

History and origin, definition and evolution of various related terminologies.

UNIT II

Concept and philosophy, ecological principles, economic threshold concept, and economic consideration.

UNIT III

Tools of pest management and their integration- legislative, cultural, physical and mechanical methods; pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost-benefit ratios and partial budgeting; case studies of successful IPM programmes.

ENT 511 PESTS OF FIELD CROPS **1+1 Theory**

Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors.

UNIT I

Insect pests of cereals and millets and their management. Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs etc.).

UNIT II

Insect pests of pulses, tobacco, oilseeds and their management.

UNIT III

Insect pests of fibre crops, forages, sugarcane and their management.

ENT 512 PESTS OF HORTICULTURAL AND PLANTATION CROPS **1+1 Theory**

Systematic position, identification, distribution, host range, bionomics and seasonal abundance, nature and extent of damage and management of insect pests of various crops.

UNIT I

Fruit Crops- mango, guava, banana, jack, papaya, pomegranate, litchi, grapes, ber, fig, citrus, aonla, pineapple, apple, peach and other temperate fruits.

UNIT II

Vegetable crops- tomato, potato, radish, carrot, beetroot, cole crops, french beans, chow- chow, brinjal, okra, all gourds, gherkin, drumstick, leafy vegetables etc.

UNIT III

Plantation crop- coffee, tea, rubber, coconut, arecanut, cashew, cocoa etc.; Spices and Condiments- pepper, cardamom, clove, nutmeg, chillies, turmeric, ginger, beetlevine etc.

UNIT IV

Ornamental, medicinal and aromatic plants and pests in polyhouses/protected cultivation.

Syllabus of Plant Pathology for conducting PhD Entrance Examination

PL PATH 501 Mycology

Introduction, definition of different terms, basic concepts. Importance of mycology in agriculture, relation of fungi to human affairs, history of mycology. Concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi. The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Lichens types and importance, fungal genetics and variability in fungi.

PL PATH 502 Plant Virology

History of plant viruses, composition and structure of viruses. Symptomatology of important plant viral diseases, transmission, chemical and physical properties, host virus interaction, virus vector relationship. Virus nomenclature and classification, genome organization, replication and movement of viruses. Isolation and purification, electron microscopy, protein and nucleic acid based diagnostics. Mycoviruses, phytoplasma arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, prions. Principles of the working of electron-microscope and ultramicrotome. Origin and evolution, mechanism of resistance, genetic engineering, ecology, and listing of important diseases and their management.

PL PATH 503 Plant Bacteriology

History and introduction to phytopathogenic procarya, viz., bacteria, MLOs, spiroplasmas and other fastidious procarya. Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic procarya and list of important diseases caused by them. Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya. General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios. Procaryotic inhibitors and their mode of action against phytopathogenic bacteria. Survival and dissemination of phytopathogenic bacteria.

PL PATH 504 Principles of Plant Pathology

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases. Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development.Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens. Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance. Disease management strategies.

PL PATH 505 Detection and Diagnosis of Plant Diseases

Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens. Preservation of plant pathogens and disease specimens, use of centrifuge, pH meter, micrometer, haemocytometer, camera lucida. Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of manuscripts.