FACULTY OF AGRICULTURE & FORESTRY

SYLLABUS

For

M.Sc. AGRICULTURE

(SEMESTER: I –IV)

Session: 2017-18

GURU NANAK DEV UNIVERSITY
AMRITSAR

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER–I

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pr.	Th.	Pr.	Th.	Pr.	Th.	Pr.	
AGR-511	Modern Concepts in Crop Production	4	3	80	40	20	10	100	50	150
AGR-512	Soil Fertility & Nutrient Management	4	6	80	40	20	10	100	50	150
AGR-513	Principles and Practices of Water Management	4	3	80	40	20	10	100	50	150
SSC- 410 (Minor)	Soil Chemistry and Bio Chemistry	4	6	80	40	20	10	100	50	150
STA-415	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
*AGR-411	Weed Management									NC
*AGR-412	Crop Production under Special Situations									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

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SEMESTER–II

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pr.	
AGR- 521	Principles and Practices of Weed Management	4	3	80	40	20	10	100	50	150
AGR- 522	Agronomy of Oil Seeds, Fibre and Sugar Crops	4	6	80	40	20	10	100	50	150
AGR- 523	Field Plot Techniques	4	3	80	40	20	10	100	50	150
SSC-420/ (Minor)	Soil Fertility and Fertilizer Use	4	6	80	40	20	10	100	50	150
STA-425	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
*AGR-421	Farming Systems and Sustainable Agriculture									NC
*AGR-424	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

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SEMESTER-III

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th	Pract	Th	Pract	Th	Pract	Th	Pract	
AGR-531	Agronomy of Major Cereals and Pulses	4	3	80	40	20	10	100	50	150
AGR-532	Principles and Practices of Organic Farming	4	6	80	40	20	10	100	50	150
SSC-430 BOT-430 AGM-430 (Minor)	Fertilizer Technology / Physiology of Growth & Development/ Fundamentals of Agroclimatology	4	3	80	40	20	10	100	50	150
	Credit Seminar	3		100				100		100
	Research Work (Four Periods per Teacher per Student)		4							
Total		**15**	**16**	**340**	**120**	**60**	**30**	**400**	**150**	**550**

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SEMESTER-IV

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th	Pract	Th	Pract	Th	Pract	Th	Pract	
AGR-541	Cropping Systems and Sustainable Agriculture	4	3	60	20	15	05	75	25	100
AGR-542	Dry Land Agriculture and Water Shed Management	4	3	60	20	15	05	75	25	100
	Research Work (Four Periods per Teacher per Student)		4		250				250	250
	Total	**08**	**10**	**120**	**290**	**30**	**10**	**150**	**300**	**450**

M.Sc. AGRICULTURE
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SEMESTER-I

AGR-511: Modern Concepts in Crop Production

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

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.

Practical

Time: 3 Hours

Analysis of Growth & Development; leaf area index, Crop Growth rate, Relative growth rate, etc; Estimation of yield, mulching, cropping scheme, crop rotation, comparison of chemical & organic farming; Quality standards for organic farming.

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SEMESTER-I

AGR-512: Soil Fertility and Nutrient Management

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

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 vermicomposting and residue wastes in crops.

Practical: **Time: 3 Hours**

Determination of soil pH, EC, organic C total N; available N, P, K and S in soils; determination of total N, P, K and S in plants; interpretation of interaction effects and computation of economic and yield optima.

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SEMESTER-I

AGR-513: Principles and Practices of Water Management

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
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4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states. 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. 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 polyhouses. Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency. Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing.

Practical: **Time: 3 Hours**

Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus; soil-moisture characteristics curves; water flow measurements using different devices; determination of irrigation requirements; calculation of irrigation efficiency; determination of infiltration rate; determination of saturated? unsaturated hydraulic conductivity.

M.Sc. AGRICULTURE
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SEMESTER-I

SSC-410: Soil Chemistry and Bio–Chemistry (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Soil colloids–nature, properties, origin of charges and their significance; Cation and anion exchange phenomena and their importance; Introduction to ionic adsorption and fixation; Soil reaction and buffering; Distribution, characterization, genesis and amelioration of acid, acid sulphate, saline, saline-sodic, sodic and calcareous soils; Plant reaction and tolerance to soil salinity, sodicity and acidity; Chemical and electro chemical properties of submerged soils; Organic matter and characterization of clay –organic matter interaction ; Biochemical decomposition of organic manures and farm wastes, composting and vermicomposting .Biochemistry of humus formation and biogas production **.**

Practical: **Time: 3 Hours**

Determination of the effect of dilution and salinity on soil pH; Active and potential acidity; Cation and anion exchange capacity and exchangeable cations; Soluble salts in soils; Lime and gypsum requirements. Nutrient adsorption and fixation capacities of soils; Estimation of biochemical constituents of organic residues- cellulose, hemi-cellulose, lignin and C: N ratio. Preparation of enriched compost, biofertilizers and vermiculture.

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SEMESTER-I

STA-415: Statistical Methods for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

Theory

Probability and fitting of standard frequency distributions, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intraclass correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal call frequencies, transformation of data.

Practical: **Time: 3 Hours**

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Note: Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students are allowed to use scientific calculators to analysis is the data.

M.Sc. AGRICULTURE
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SEMESTER-I

AGR-411 **Weed Management**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Weeds- Introduction, harmful and beneficial effects, characteristics and classification. Weed biology and ecology. Crop weed association, competition and allelopathy. Concepts of weed prevention, control and eradication. Methods of weed control. Physical, cultural, chemical, biological and integrated weed management. Herbicides- classification, formulation, advantages ,disadvantages and methods of application. Introduction to adjuvant and their use in herbicides. Introduction to selectivity of herbicides. Mode of action and fate of herbicides in soil. Compatibility of herbicides with other agrochemicals. Weed management in major field and horticultural crops and in non cropped areas. Shift in weed flora in cropping systems. Classification, useful and harmful aspects and control measures of aquatic weeds. Problematic weeds and their control.

Practical:

Identification of weeds and weed seeds. Survey of weeds in crop fields and other habitats. Preparation of weed herbarium. Computation of herbicide doses, weed control efficiency and weed index. Methods of recording weed intensity under different situations. Herbicide label information of commonly available herbicides. Herbicide application equipments and their calibration. Diagnosis of herbicide toxicity symptoms in different crops and weeds. Visits to problem areas.

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SEMESTER-I

AGR-412 Crop Production under Special Situations

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal assessment: 20
Periods per Week 4+0

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Dry Farming: extent, and problems. Distribution of low rainfall areas. Effect of moisture stress on physiological processes. Plant water relationships, special characteristics of plants, seed treatments, water conservation characteristics, fertilizer management, mixed cropping, crop and variety selection, crop sequences, use of mulches and chemicals to save water and crop diversification in dry farming. Contingency crop planning for aberrant weather conditions. Problematic soils, crop management problems of water logged, saline, alkali soils; agronomic practices with special reference to crop rotations, planting techniques, irrigation management, weed control and fertilizer use in problematic soils. Raising fodders- Role of fodder crops and pastures in farm economy, raising of different fodders, fodder quality, fodder preservation and factors affecting quality of preserved fodder, silage and hay making.

Plant nutrients-, functions, deficiency symptoms, content and distribution in soils, nutrient transformations, retention and availability, nutrient interactions. Methods of soil fertility evaluation, fertilizers and their fate in soil, crop response to fertilizers, fertilizer use efficiency, time and mode of fertilizer application. Concept of integrated fertilizer use and water management in soil. Nutrient removal by crops, maintenance of soil fertility. Current fertilizer consumptions, future trends and needs.

M.Sc. AGRICULTURE
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SEMESTER-II

AGR-521: Principles and Practices of Weed Management

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

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, mycoherbicides 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.

Practical: **Time: 3 Hours**

Identification of important weeds of different crops; preparation of a weed herbarium; weed survey in crops and cropping systems; crop-weed competition studies; preparation of spray solutions of herbicides of high and low-volume sprayers; use of various types of spray pumps and nozzles and calculation of swath width; economics of weed control; herbicide residue analysis in plant and soil; bioassay of herbicide residue; calculation of herbicidal requirement.

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SEMESTER-II

AGR-522: Agronomy of Oil Seeds, Fibre and Sugar Crops

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Origin, history, area and production, classification, improved varieties, adaptability, climate, soil water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Rabi, oilseeds – Rapeseed and mustard, linseed, etc. Kharif oilseeds – Groundnut, sesame, castor, sunflower, soybean etc. Fiber crops – Cotton, jute, sunhemp etc. Sugar crops – Sugar-beet and sugarcane.

Practical: **Time: 3 Hours**

Planning and layout of field experiments; cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane; determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice phonological studies at different growth stages of crop; intercultural operations in different crops; cotton seed treatment; working out growth indice (LER, CGR, RGR, NAR, LAD) aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems; judging of physiological maturity in different crops;; working out harvest index; working out cost of cultivation of different crops; estimation of crop yield on the basis of yield attributes; formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; determination of oil content in oilseeds and computation of oil yield; estimation of quality of fibre of different fibre crops; study of seed production techniques in various crops; visit of field experiments on cultural, fertilizer, weed control and water management aspects; visit to nearby villages for identification of constraints in crop production.

M.Sc. AGRICULTURE
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SEMESTER-II

AGR-523: Field Plot Techniques

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Planning field experiments - objectives, selection of field and treatment. Conduct of the experiment, precautions during sowing management, harvesting and threshing - Sampling. Recording biometrical observations. Source of error in the field experiments and methods of reducing it. Optimum plot size and number of replications. Selection of experimental designs. Rotational experiments. Experiments to study the effect of years and locations compilation, presentation and interpretation of the data. Factorial experiments and interaction effects. Different tests of significance. Correlation and response functions. Transformation of data.

Practical: **Time: 3 Hours**

Actual layout of field experiments. Critica examination of experiments scientific journals. Compilation aid interpretation of the given data. Missin lots and analysis of variance results. Use of computers for analysis

M.Sc. AGRICULTURE
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SEMESTER-II

SSC-420 Soil Fertility and Fertilizer Use (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Plant growth – factors affecting, growth equations; Plant nutrients-functions, deficiency symptoms;, content and distribution in soils; Nutrient toxicities nutrient transformations, retention and availability; Nutrient interactions; Nutrient removal by crops; Methods of soil fertility evaluation; Maintenance of soil fertility; Fertilizers and their fate in soils; Crop responses to fertilizers; Fertilizer use efficiency; Principles of time and mode of fertilizer application; integrated use of fertilizers and manures; Nutrient release and carry -over effects; Current fertilizer production and consumption, future trends and needs in India.

Practical: **Time: 3 Hours**

Analysis of soils for different forms of nitrogen, phosphorus, potassium and sulphur; Determination of DTPA extractable micronutrients; Plant analysis for nitrogen, phosphorus, potassium, calcium, magnesium and sulphur; Diagnosis and management of nutrient deficiencies and toxicities.

M.Sc. AGRICULTURE
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SEMESTER-II

STA-425: Experimental Designs for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

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4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data, completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions, orthogonality and partitioning of degrees of freedom confounding in 2^3 , 2^4 and 3^3 designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments; Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

Practical: **Time: 3 Hours**

and balanced incomplete block designs.

Note: Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students are allowed to use scientific calculators to analysis is the data.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

M.Sc. AGRICULTURE
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SEMESTER-II

***AGR-421 Farming Systems and Sustainable Agriculture**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Farming systems, definition, principles and components. Farming System models for irrigated, dryland situations and modules for marginal, small and large farmers. Farming systems of the world-arable, pastoral, lay farming, shifting cultivation, ranching and agro-forestry systems. Energy and fuel wood plantations. Specialized and diversified farming, family co-operative and collective farming: their occurrence, adaptations and weaknesses. Factors affecting choice of farming systems. Cropping systems, their characteristics and management. Cropping patterns. Agro-ecosystem and agro-ecological zones of India. Efficient food producing systems. Sustainable agriculture- Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures, land degradation and conservation of natural resources.

Practical:

Preparation of cropping scheme and integrated farming system models for irrigated and dry land situations. Preparation of enriched Farm Yard Manure and Vermicompost. Visit to urban waste recycling unit, organic farm and model farmers' field. Preparation of farm lay out plans, different intensity crop rotations and cropping schemes. Estimating crop yields. Energy budgeting in different crops and cropping systems. Working out ecological optimum crop zones. Project making exercises for establishment of crop production farms under different situation.

M.Sc. AGRICULTURE
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SEMESTER-II

***AGR-424 Production Technology of Spices, Aromatic, Medicinal and Plantation Crops**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

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5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Important Spice crops- Ginger, Turmeric, Dill Seed, Pepper, Cardamom, Coriander, Cumin, Fennel, Celery and Fenugreek. Aromatic crops- Mentha, Lemongrass, Citronella, Palmarosa, Vetiver and Geranium. Medicinal plants- Discordia, Rauvolfia, Opium, Periwinkle, Guggal, Belladonna, Nuxvomica, Solanumnigrum, Senna, Amla, Isabgol, Coleus, Acorus and Pipli (mug); Plantation crops- Coconut, Areca nut, Betel vine, Cashew, Cocoa and Coffee with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Practical:

Identification of crops based on morphological and seed characteristics. Propagation, seed selection, seed treatment, processing and distillation techniques for different medicinal, aromatic and spice crops.

M.Sc. AGRICULTURE
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SEMESTER-III

AGR-531: Agronomy of Major Cereals and Pulses

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Origin, history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Kharif and Rabi cereals and pulses.

Practical: **Time: 3Hours**

Phonological studies at different growth stages of crop; estimation of crop yield on the basis of yield attributes; formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; working out growth indices (CER, CGR, RGR, NAR, LAD); aggressiveness, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems of different crops; estimation of protein content in pulses; planning and layout of field experiments; judging of physiological maturity in different crops; intercultural operations in different crops; determination of cost of cultivation of different crops; working out harvest index of various crops; study of seed production techniques in various crops; visit of field experiments on cultural, fertilizer, weed control and water management aspects and visit to nearby villages for identification of constraints in crop production

M.Sc. AGRICULTURE
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SEMESTER-III

AGR-532: Principles and Practices of Organic Farming

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the paper setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
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5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management**,** agro-forestry**.** Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers. Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity. Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides. Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

Practical: **Time: 3 Hours**

Aerobic and anaerobic methods of making compost; making of vermicompost; identification and nursery raising of important agro-forestry tress and tress for shelter belts; efficient use of biofertilizers, technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field; visit to an organic farm; quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms.

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-III

SSC-430 Fertilizer Technology (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Fertilizer industry in India; Raw materials; Manufacture of different types of fertilizers including reactions and flow diagrams; Granulation, segregation, caking, drying and cooling of fertilizers; Complex, mixed, liquid, suspension and slow release fertilizers; Production of fertilizers containing secondary and micronutrients; Changing trends in fertilizer technology.

Practical:

Collection of soil and fertilizer samples; Preparation of standard solutions. Colorimetric and flame photometric methods; Analysis of soil for fertilizer recommendations and suitability for orchard plantation; Gypsum and lime requirements of soil; Analysis of fertilizer for quality control; Planning and formulation of project on establishment of soil and fertilizer testing laboratories. Visit to fertilizer factories.

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-III

BOT-430 **Physiology of Growth and Development**
Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Concepts of growth, differentiation and pattern formation; growth curves, meristems, growth kinetics, factors affecting growth and general aspects of development, level of differentiation, control of development at genetic level. Hormones and growth regulators - auxins, gibberellins, cytokinins, ethylene, ABA, other inhibitors, retardants, polyamines, aliphatic alcohols, brassins, hormonal regulation of growth and development, plant movements; photoperiodism, phytochrome, flowering hormones, vernalization, abscission, ageing, senescence; physiology of seed and fruit development; seed germination; seed and bud dormancy. Plant physiology and agriculture.

Practical:

Experiments on growth measurements, hormonal bioassays, plant movements; experiments on quality of light on seed germination, breaking of dormancy. Experiments on photoperiodism. Experiments on hormonal regulation of development.

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-III

AGM-430 Fundamentals of Agroclimatology (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Survey of the atmosphere; introduction to basic meteorological processes; nature, receipt and disposal of solar radiation; Atmospheric humidity and forms condensation; Evaporation and evapotranspiration ; Winds, air masses and disturbance ;influence of climate on plants, animals and pests; Meterological droughts; indices in agroclimatrology ; Agroclimatic classifications and their application; field climate modification.

Practical:

Meteorological instruments and their use in the measurement of agroclimatic environment; Measurement of field climate; Computation of agroclimatic indices-GDD, PTU, PET etc; Determining crop production sensitivity to weather.

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-III

CREDIT SEMINAR

Total Marks: 100
Periods per week: 03

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-IV

AGR-541: Cropping Systems and Sustainable Agriculture

Time: 3 Hours **Max. Marks: 100**

Theory: 60

Practical: 20

Internal assessment 15+5=20

Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use. Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems. Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture. Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Plant ideotypes for drylands; plant growth regulators and their role in sustainability

Practical: **Time: 3 Hours**

Preparation of Models of different Cropping Systems. Interaction Studies of different component Crops. Assessment of yield Advantages i.e. CEY, LER, RYT, Assessment of Land Use and Economic Evaluations.

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-IV

AGR-542: Dry Land Agriculture and Water Shed Management

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 20
Internal assessment 15+5=20
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture. Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions. Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions. Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use. Concept of watershed resource management, problems, approach and components.

Practical: **Time: 3 Hours**

Seed treatment, seed germination and crop establishment in relation to soil moisture contents; moisture stress effects and recovery behaviour of important crops; estimation of moisture index and aridity index; spray of anti-transpirants and their effect on crops; collection and interpretation of data for water balance equations; water use efficiency; preparation of crop plans for different drought conditions; study of field experiments relevant to dryland farming; visit to dryland research stations and watershed projects.

M.Sc. AGRICULTURE
(AGRONOMY)

SEMESTER-IV

RESEARCH WORK

Total Marks: 250
Periods per week: 04

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
AGE-511	Agri. Marketing & Price Analysis	4	3	80	40	20	10	100	50	150
AGE-512	Econometrics	4	3	80	40	20	10	100	50	150
AGE-513	Farm Management Economics	4	6	80	40	20	10	100	50	150
SSC-410/ AGR-410 (Minor)	Soil Chemistry and Bio Chemistry/ Crop Ecology	4	6	80	40	20	10	100	50	150
STA-415	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
*AGE-414	Micro Economic Analysis									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Pract.**	**Th.**	**Pract.**	**Th.**	**Pract.**	**Th.**	**Pract.**	
AGE-521	Agricultural Production Economics	4	6	80	40	20	10	100	50	150
AGE-522	Research Methodology for Social Sciences	4	3	80	40	20	10	100	50	150
AGE-523	Agri. Finance & Project Management	4	3	80	40	20	10	100	50	150
AGE-524	Linear Programming	4	3	80	40	20	10	100	50	150
AGR-420/ VSC-420 (Minor)	Farm Cropping System / Fundamentals of Vegetable Production	4	6	80	40	20	10	100	50	150
*AGE-422	Macro Economic Analysis									NC
*AGE-423	Economic problems of Agriculture in India									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
			Th	Pract	Th	Pract	Th	Pract	Th.	Pract	
1.	AGE-531	Micro Economics	6		80		20		100		100
2.	AGE-532	Evolution of Economic Thought	4		80		20		100		100
3.	AGE-533	Rural Marketing	4		80		20		100		100
4.	MGT-430/ STA-430 (Minor)	Agri -Business Management / Sampling Theory	4	3	80	40	20	10	100	50	150
5.		Credit Seminar	3		100				100		100
6.		Research Work (four periods per Teacher per Student)	-	4							
Total			**21**	**7**	**420**	**40**	**80**	**10**	**500**	**50**	**550**

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(AGRICULTURAL ECONOMICS)

SEMESTER-IV

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assessment		Total Marks		Grand Total
			Th	Pract	Th	Pract	Th	Pract	Th	Pract	
1.	AGE-541	Macro Economics and Policy	6		80		20		100		100
2.	AGE-542	Agricultural Development and Policy	6		80		20		100		100
3.		Research work (Four Periods per Teacher per Student)		4		250				250	250
Total			**12**	**04**	**160**	**250**	**40**	**-**	**200**	**250**	**450**

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

AGE-511: Agricultural Marketing and Price Analysis

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Market structure, conduct and performance analysis. Problems in Agricultural Marketing from Demand, Supply and Institutions sides. Market intermediaries and regulation. Marketable & Marketed surplus estimation. Marketing Efficiency. Vertical and Horizontal integration. Marketing Co-operatives – APMC, 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, 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.

Practical: **Time: 3 Hours**

Training of supply and demand elasticities, price spread, price forecasting, concentration ratios and marketing efficiency analysis. Marketing structure analysis of regulated market and marketing societies. Analysis on contract farming and supply chain management. Chain Analysis - quantitative estimation of supply chain efficiency. Online searches for market information sources and interpretation of market intelligence reports. Technical and fundamental Analysis for important agricultural commodities- presentation of the survey results and wrap-up discussion.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

AGE-512: Econometrics

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Introduction – relationship between economic theory, mathematical economics, models and econometrics, methodology of econometrics-regression analysis.Basic two variable regression - assumptions estimation and interpretationapproaches to estimation - OLS, MLE and their properties - extensions to multi variable models-multiple regression estimation and interpretation. Violation of assumptions – identification, consequences and remedies for Multicollinearity, heteroscedasticity, autocorrelation – data problems and remedialapproaches - model misspecification. Use of dummy variables-limited dependent variables – specification, estimation and interpretation. Simultaneous equation models – structural equations - reduced form equations -identification and approaches to estimation.

Practical: **Time: 3 Hours**

Practicals on single equation two variable model specification and estimation, hypothesis testing, transformations of functional forms and OLS application. Estimation of multiple regression models - hypothesis testing, testing and correcting specification errors, testing and managing multicollinearity, heteroscedasticity, autocorrelation. Estimation of regressions with dummy variables, estimation of regression with limited dependent variable. Identification of equations in simultaneous equation systems.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

AGE-513: Farm Management Economics

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 4+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Meaning and functions; development of farm management as a science, management factor in commercial agriculture. Organization and operation of the farm business for optimal resource use. Cost and returns concepts. Relationship between different farm enterprises. Farm adjustment programmes under uncertain conditions. Farm records and accounting. Efficiency measures for different types of enterprises and farm business.

Practical: **Time: 3 Hours**

Preparation of layout maps, maintenance of farm business records, summarization and analysis of the accounts and preparation of enterprise, labour and partial budgets, alternative plans and control charts in respect of the assigned farm.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

SSC-410 Soil Chemistry and Bio Chemistry (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week: 04+06

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Soil colloids–nature, properties, origin of charges and their significance; Cation and anion exchange phenomena and their importance; Introduction to ionic adsorption and fixation; Soil reaction and buffering; Distribution, characterization, genesis and amelioration of acid, acid sulphate, saline, saline-sodic, sodic and calcareous soils; Plant reaction and tolerance to soil salinity, sodicity and acidity; Chemical and electro chemical properties of submerged soils; Organic matter and characterization of clay –organic matter interaction ; Biochemical decomposition of organic manures and farm wastes, composting and vermicomposting .Biochemistry of humus formation and biogas production .

Practical: **Time: 3 Hours**

Determination of the effect of dilution and salinity on soil pH; Active and potential acidity; Cation and anion exchange capacity and exchangeable cations; Soluble salts in soils; Lime and gypsum requirements. Nutrient adsorption and fixation capacities of soils; Estimation of biochemical constituents of organic residues- cellulose, hemi-cellulose, lignin and C: N ratio. Preparation of enriched compost, biofertilizers and vermiculture.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

AGR-410 **Crop Ecology (Minor)**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Ecology in relation to crop; Eco system- components and energy flow- food chain and energy output relationships; Agro- ecosystem and agro-ecological zones of India; Efficient food producing systems; Farming system of the world-arable, pastoral, lay farming, shifting cultivation, ranching and agro-forestry systems, energy and fuel, wood plantations; Specialized and diversified forming; Family, co-operative and collective farming, their occurrence and adaptation and weakness; Cropping systems, their characteristics and management; Cropping patterns; Farm selection , size of the farm and farm layout, cropping schemes and crop plans ; Solar radiation concepts, laws and their absorption in crop system; Bio-geo-chemical cycle and their significance.

Practical: **Time: 3 Hours**

Analysis of crop ecosystem components; Light measurement in pure and mixed crop stands; Modification in crop environment; Measuring temperature, light and moisture effects: Preparation of farm lay out plans, different intensity crop rotations and cropping schemes; Estimating crop yields; Energy budgeting in different crops and cropping systems; Working out ecological optimum crop zones.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

STA-415: Statistical Methods for Research Workers

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.

Practical: **Time: 3 Hours**

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Note: Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students will use scientific calculators to analyse the data.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-I

***AGE-414 Micro Economic Analysis**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Micro Economics: meaning, definition, importance, nature and scope. Theory of consumer behavior: marginal utility analysis and indifference curve analysis. Demand analysis: meaning, definition, derivation of demand curve. Firm and industry: meaning, types, difference between firm and industry, equilibrium conditions, short-run and long-run analysis. Production: meaning, process and factors of production, relationship between production and different factors, production lags. Theory of producer behavior production function, costs, optimization of inputs use and product combinations, maximization of returns, specialization and diversification and supply analysis. Product market: meaning, types, assumptions, conditions of perfect and imperfect markets. Equilibrium of a firm and industry, determination of price and output of commodities under different market situations. Factor pricing: meaning, different theories for determination of rent, wages, interest and profit.

Practical:

Practical training to study consumer behavior in relation to demand of various commodities, consumer survey. Economic analysis of a firm and industry. Working knowledge of relationship between production and different factors of production, production costs and optimum input use. Product market survey. Practical training of price determination in different types of markets.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

AGE-521: Agricultural Production Economics

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Nature, scope and significance of agricultural production economics- Agricultural Production processes. Production functions, assumptions, commonly used forms, properties, limitations, specification, estimation and interpretations. 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, 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, modelling and coping strategies.

Practical: **Time: 3 Hours**

Different forms of production functions -specification, estimation and interpretation of production functions – returns to scale, factor shares, elasticity of production - physical optima-economic optima-least cost combination- optimal product choice- cost function estimation, interpretation-estimation of yield gap - incorporation of technology in production functions-measuring returns to scale-risk analysis through linear programming.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

AGE-522: Research Methodology for Social Sciences

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Importance and scope of research in social sciences. Concept and characteristics of social research. Types of research. Fundamental vs. Applied. Concept of researchable problem – research prioritization, research process. Hypothesis – meaning, characteristics, types and testing. Review of literature. Development of theoretical orientation of the research problem. Concept, construct, variables and their measurement. Sampling design, sampling error and methods of sampling. Research design and techniques. Types of data collection tools and testing their reliability and validity. Scaling techniques. Coding, editing, tabulation and validation of data. Tools of data analysis. Statistical package for social sciences, interpretation of results, preparing research report / thesis. Writing of articles. Universal procedures for preparation of bibliography.

Practical: **Time: 3 Hours**

Selection and formulation of research problem, objectives and hypothesis. Selection of variables and their operationalization. Developing conceptual framework of research. Development of data collection tools and measuring their validity and reliability. Data processing, tabulation and analysis. Formulation of secondary tables. Writing of thesis and research articles. Presentation of reports.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

AGE-523: Agri. Finance and Project Management

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

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. Financial Decisions – Investment, Financing, Liquidity and Solvency. Financial statements - Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis. 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.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

AGE-523: Agri. Finance and Project Management

Practical: **Time: 3 Hours**

Estimation of demand and supply gaps of institutional agricultural credit. Preparation of farm credit plan and financial statements using farm/firm level data. Farm credit appraisal techniques and farm financial analysis through financial statements. Performance of Micro Financing Institutions - NGO's and Self-Help Groups. Identification and formulation of agricultural investment projects. Practical training of project appraisal techniques. – Undiscounted and Discounted Measures along with their limitations. Case Study Analysis of an Agricultural project, Financial Risk and risk management strategies.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

AGE-524 Linear Programming

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Decision Making- Concepts of decision making, introduction to quantitative tools, introduction to linear programming, uses of LP in different fields, graphic solution to problems, formulation of problems. Simplex Method: Concept of simplex Method, solving profit maximization and cost minimizations problems. Formulation of farms and non farm problems as linear programming models and solutions. Extension of Linear Programming models: Variable resource and price programming, transportation problems, recursive programming, dynamic programming. Game Theory- Concepts of game theory, two person constant sum, zero sum game, saddle point, solution to mixed strategies, the rectangular game as linear programme.

Practical: **Time: 3 Hours**

Graphical and algebraic formulation of linear programming models. Solving of maximization and minimization problems by simplex method. Formulation of the simplex matrices for typical farm situations.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

AGR-420 Farm Cropping System (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

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4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Farming systems-introductions terms and definitions ; Concept and its role in sustainability of agriculture; Factor effecting choice of farming system; Resource management in relation to farm cropping system; Crop yield appraisals; Plant interaction, criteria for assessing yield advantages ;Indices for evaluating productivity and efficiency; Agronomic consideration interaction in sequential cropping ; Evaluation and productivityof multiple cropping systems; Cropping systems in dry land farming; Cropping systems for irrigated areas; Cropping systems in high rainfall areas; Cropping systems with perennials; Introduction to agro forestry concept; Physiological and actual maturity of crop and criteria of crop harvest; Comparison of chemical and organic farming;

Practical: **Time: 3 Hours**

Visit to farming system and agro-based industries; Farm lay out plan, cropping scheme; Practical study of raising crops: Wheat, Rice, Maize Sugarcane, Groundnut, Toria, Gobi Sarson; Estimation of crop yield, calculation of harvest index, land equitant ratio in mixed crops/ intercrops.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

VSC-420 Fundamentals of Vegetable Production (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Role of soil, climatic and agronomic factors in vegetable production; Principles of cultivation including direct sowing; Nursery management, transplanting, hardening of seedlings and vegetable forcing ; Weeds and their control ; Rotation and intercropping in vegetable crops; Export potentiality, post harvest handling processing , storage and marketing of vegetable.

Practical: **Time: 3 Hours**

Sowing and transplanting of vegetable crops: Effect of soil conditions on emergence of seedlings and plant growth; Nutrient deficiency symptoms; Common weeds, their identification and control; project formulation and evaluation for vegetable nursery production and vegetable forcing techniques.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

***AGE-422** **Macro Economic Analysis**

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal assessment : 20
Periods per Week 4+0

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Macro Economics: meaning, definition, importance, limitations, scope and integration of micro and macro analysis. Basic macroeconomic concepts. National income: meaning, definition, types, measurement and social accounting. Circular flow of money. Simple Keynesian model of income determination, shifts in aggregate demand. Multiplier. Theories of consumption and investment. Income determination model including money and interest. Monetary policy: meaning, instruments, indicators, lags and effectiveness. Fiscal policy: meaning, definition, different tools and limitations. Wage and employment policies: meaning, need, demand and supply of labor, measures of full employment, relationship between level of employment and output. Inflation and recession: process, causes, types and remedies.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-II

***AGE-423 Economic problems of Agriculture in India**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Trends in agriculture production &productivity. Deceleration of agriculture growth rates in India, causes and effective measures to check it. Land reforms: Objectives, Measures, Achievements and shortcomings. Cooperative forming-Meaning objectives, types, merits & demerits, success and failure of cooperative sector in India. Rural indebtness: causes, effects, government measure to control it. Recommendations of Dr. Radha Krishnan's and RBI report on indebtness. Rural poverty; measurement and poverty alleviation programmes. Agriculture labor in India problems and remedies. Agricultural taxation: case for agricultural taxation, case for special treatment.

Practical:

Visit to wholesale & retail Mandis to study Marketing methods and practices with respect to major Agriculture commodities, Preparation of report, Visit to market committee to know the facilities provided to the farmers, various market charges paid by farmers & buyers, Preparation of family budget of two farmers, Tabulation of information to show the major items of expenses, food & clothing habits, housing & other facilities, Preparation of report.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

AGE-531: Micro Economics

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal assessment 20
Periods per week: 06

Instructions for the paper setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Theory of consumer behavior – Cardinal Utility Approach, Ordinal Utility Approach, Applications of Indifference Curve Approach, Revealed Preference Hypothesis. Demand theory, elasticity of demand. Consumer surplus. Theory of the firm. Theory of Production – Production functions, Returns to scale and economies of scale. Theory of Costs – Cost curves, Profit maximization and cost minimization. Law of Supply, Producers' surplus Price determination under various market situations – Monopoly, Monopolistic competition, Oligopoly. Theories of distribution. General Equilibrium Theory. Welfare Economics.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

AGE-532: Evolution of Economic Thought

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal assessment 20
Periods per week :04

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

History of economic thought - Absolutist vs. Relativist approaches. Evolution of Economic Thought Vs. Economic History. Ancient economic thought - medieval, mercantilism,' physiocracy. Forerunners of Classical Political Economy. Development of Classical Thoughts (Adam Smith, Robert Malthusand David Ricardo). Critics of Classical Thoughts- Socialist critics. Socialist and Marxian Economic Ideas. Austrian School of Thought .Origins of formal Microeconomic Analysis - William Stanley Jevons, Cournot and Dupuit The birth of neoclassical economic thought Marshall and Waltras. General Equilibrium Theory. Welfare Theory - Keynesian economics. The Era of globalization . Experiences of developing world.

Rigidity of the past vs. emerging realism The changing path of international institutions to economic groW1h and development approaches. Economic Thought in India - Naoroji and Gokhale. Gandhian Economics. Economic thought of independent India.. Nehru's economic philosophy. Experiences of the Structural adjustment programmes of the post liberalization era.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

AGE-533: Rural Marketing

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal assessment 20
Periods per week (Th): 04

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Concept and scope of rural marketing- nature, characteristics and potential. Environmental factors - socio-cultural, economic and other environmental factors affecting rural marketing. Rural consumer's behaviour - behaviour of rural consumers and farmers; buyer characteristics and buying behaviour. Rural v/s urban markets. Rural marketing strategy - marketing of consumer durable and non-durable goods and services in the rural markets with special reference to product planning; product mix, pricing course objective, pricing policy and pricing strategy. Input marketing in the rural areas, Inter linkage of rural marketing with credit. Product promotion - Media planning, planning of distribution channels, and organizing personal selling in rurall1larket in India.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

MGT-430: Agri -Business Management (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Nature of agri-business; evolution and changing dimensions of agri-business in India; Characteristics of production, consumption and marketable surplus of agricultural output; Type and Characteristics of marketing of agricultural products, problems of agricultural marketing in India; Rural marketing, distribution system, marketing of agricultural inputs; Marketing by the government, functioning of selected procurement agencies; Locational factors and other problems in processing of agricultural products; Management of agro-industries.

Practical:

Students visit to wholesale grain market, fruits and vegetables market for understanding the composition, functioning and problems in marketing systems; Case studies, analysis and discussion. To suggest improvements in present marketing structure.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

STA-430: Sampling Theory (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Advantages, uses and steps involved in sample surveys, design and organization of pilot and large sample surveys, sampling from finite populations, simple random sampling, inverse sampling, use of anciliary information, ratio, product, difference and regression methods of estimation, pps sampling, stratified random sampling, estimation of proportion, cluster sampling, systematic sampling and multistage sampling, double sampling, non-sampling errors- their control and estimation, randomized response techniques, design of agricultural and forestry surveys, national sample surveys , recent developments in sampling.

Practical: **Time: 3 Hours**

Simple random sampling, probability proportional to size sampling, use of auxiliary information at estimation stage, systematic, stratified, cluster and multistage sampling and double sampling.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-III

CREDIT SEMINAR

Total Marks: 100
Periods per week: 03

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-IV

AGE-541: Macro Economics and Policy

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal Assessment=20
Periods per week :06

Instructions for the paper setters:

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3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Nature and Scope of Macro Economics. National Income - concepts and measurement. Classical theory of Employment and Say's Law. Modem 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-Classical theories of Money and Price. Keynesian theory of money. Supply of Money. Demand for Money. Inflation nature, effects and control. IS & LM framework - 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.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-IV

AGE-542: Agricultural Development and Policy

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal Assessment=20
Periods per week :06

Instructions for the paper setters:

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5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Development Economics- Scope and Importance. Economic development and economic growth. Indicators and Measurement of Economic Development - GNP as a measure of economic growth. New Measures of Welfare - NEW and MEW, PQLI, HDI, Green GNP Criteria for under development. Obstacles to economic development - Economic and Non Economic factors of economic growth. Economic development - meaning, stages of economic development, determinants of economic growth. Theories of economic growth. Optimal Economic Growth. Recent Experiences of developing country economies in transition. Role of state in economic development. Development planning. Role of agriculture in economic/rural development. Agriculture and food supply, resource policies, credit policies, input and product marketing policies, price policies. Development issues, poverty, inequality, unemployment and environmental degradation. Models of Agricultural Development - Induced Innovation Model.

Policy options for sustainable agricultural development. Globalization and Agricultural Development. The dilemma of free trade- Free trade versus Protectionism. Role of protection in Developing Countries. WTO - Agreement on Agriculture.

M.Sc. AGRICULTURE
(AGRICULTURAL ECONOMICS)

SEMESTER-IV

RESEARCH WORK

Total Marks: 250
Periods per week: 04

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
FSC-511	Tropical Fruit Production and Dry Land Horticulture	4	3	80	40	20	10	100	50	150
FSC-512	Nutrient and Canopy Management in Fruit Crops	4	6	80	40	20	10	100	50	150
FSC-513	Systematic Pomology	4	3	80	40	20	10	100	50	150
SSC-410 (Minor)	Soil Chemistry and Bio Chemistry	4	6	80	40	20	10	100	50	150
STA-415	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
*FSC-411	Nursery Management of Horticultural Crops									NC
*FSC-412	Fundamentals of Fruit Production									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Pract.**	**Th.**	**Pract.**	**Th.**	**Pract.**	**Th.**	**Pract.**	
FSC-521	Sub Tropical and Temperate Fruit Production	4	3	80	40	20	10	100	50	150
FSC-522	Breeding of Fruit Crops	4	6	80	40	20	10	100	50	150
FSC-523	Post Harvest Technology of Fruit Crops	4	3	80	40	20	10	100	50	150
SSC-420/ PBG-420 (Minor)	Soil Fertility and Fertilizer Use/Principles of seed Production	4	6	80	40	20	10	100	50	150
STA-425	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
*FSC-421	Commercial Fruit Production									NC
*FSC-422	Processing and Value Addition of Horticultural Crops									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Prac**	**Th.**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	
FSC-531	Principles and Practices of Plant Propagation	4	3	80	40	20	10	100	50	150
FSC-532	Plant Growth Regulators in Fruit Crops	4	6	80	40	20	10	100	50	150
SSC-430 / PFE-430// BOT-430 (Minor)	Fertilizer Technology / / Protected Cultivation of Vegetables/ Physiology of Growth & Development	4	3	80	40	20	10	100	50	150
	Credit seminar	3		100				100		100
	Research Work (Four periods per Teacher per Student)	-	4							
Total		**15**	**16**	**340**	**120**	**60**	**30**	**400**	**150**	**550**

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-IV

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Prac	Th	Prac	
1	FSC-541	Citriculture	4	3	60	20	15	05	75	25	100
2.	FSC-542	Orchard Floor Management and Organic Agriculture	4	3	60	20	15	05	75	25	100
3		Research Work (Four Periods per Teacher Per Student)		4		250				250	250
		Total	**08**	**10**	**120**	**290**	**30**	**10**	**150**	**300**	**450**

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

FSC-511: Tropical Fruit Production and Dry Land Horticulture

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

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5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Origin, Distribution, Commercial Importance and Export Potential. Ecophysiological Requirements. Species and Varieties. Rootstocks and Propagation. Planting, Root Zone, Training and Pruning. Nutrition and Water Requirements, Fertigation, Role of Bio-regulators, Major Pests, Diseases, Physiological Disorders and their Control Measures. Abiotic Factors limiting Fruit Production. Flowering, Pollination and Fruit set. Quality improvement Storage and Ripening Techniques. Industrial and Export potential, Agri. Export Zones (AEZ) and Industrial Support. Fruit Crops- Itrus, Mango, Papaya, Pineapple, Banana, Avocado, Sapota, Guava, Ber, Pomegranate, Aonla, Jack Fruit, Annonas, Minor Fruits of Tropics. Possibilities and Constraints in Dry Land Fruit Production, Fruits suitable for Dry Land Horticulture.

Practical:

Time: 3 Hours

Description and Identification of Species and Varieties. Growth and Development. Growth Regulation. Nutritional and Physiological Disorders and their Control. Rejuvenation of Old and Unproductive Trees. Visit to Commercial Orchards. Project Preparation for Establishing Commercial Orchards.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

FSC-512 Nutrient and Canopy Management in Fruit Crops

Time: 3 Hours **Max. Marks: 150**

Theory:80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

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3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Essential elements, Criteria of essentiality. Natural sources and fertilizers. Role of essential elements in fruit plants. Interaction of nutrients. Canopy management, Importance and advantages. Factors affecting canopy development. Canopy types and structures. Light interception and distribution in different types of tree canopies. Spacing and utilization of land area. Canopy management through the use of rootstock and scion, plant growth inhibitors, training and pruning and management practices. Canopy development in relation to growth, flowering, fruiting and fruit quality in temperate fruits, grapes, pomegranate, mango, sapota, guava, citrus and ber.

Practical:

Time: 3 Hours

Leaf sampling techniques, Determination of nutrient status through soil and plant analysis. Study of different types of canopies. Training of plants for different canopy types. Canopy development through pruning, use of plant growth inhibitors and, geometry of planting. Effect of canopy types on production and quality of fruits.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

FSC-513 Systematic Pomology

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week: 04+3

Instructions for the Paper Setters:
1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Plant Taxonomy, Systematic pomology, its significance, systems of classification, history of systematic Pomology. Nomenclature and code of nomenclature, naming of fruit varieties, Speciation and classification of temperate, tropical and sub-tropical fruit plant species. Pomological description of temperate fruits (pear, apple, peach, plum, apricot, cherry, kiwi fruit, strawberry), citrus fruits and other major fruits (mango, guava, grapes, pomegranate, date, ber, litchi, loquat, papaya, jamun, cashewnut, banana, aonla, sapota, phalsa and cape gooseberry).

Practical: **Time: 3 Hours**

Vegetative and floral morplology of fruit plants. Description and identification of pome, stone, citrus and other major fruits (manto, guava, grapes, pomegranate, date, ber, etc etc.) Preparation and use of keys for the identification of fruit plant species and varieties. Visit to the fruit research stations for identification of different fruit species.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

SSC-410: Soil Chemistry and Bio Chemistry (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Soil colloids–nature, properties, origin of charges and their significance; Cation and anion exchange phenomena and their importance; Introduction to ionic adsorption and fixation; Soil reaction and buffering; Distribution, characterization, genesis and amelioration of acid, acid sulphate, saline, saline-sodic, sodic and calcareous soils; Plant reaction and tolerance to soil salinity, sodicity and acidity; Chemical and electro chemical properties of submerged soils; Organic matter and characterization of clay –organic matter interaction ; Biochemical decomposition of organic manures and farm wastes, composting and vermicomposting, Biochemistry of humus formation and biogas production .

Practical: **Time: 3 Hours**

Determination of the effect of dilution and salinity on soil pH; Active and potential acidity; Cation and anion exchange capacity and exchangeable cations; Soluble salts in soils; Lime and gypsum requirements. Nutrient adsorption and fixation capacities of soils; Estimation of biochemical constituents of organic residues- cellulose, hemi-cellulose, lignin and C: N ratio; Preparation of enriched compost, biofertilizers and vermiculture.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

STA-415: Statistical Methods for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.

Practical: **Time: 3 Hours**

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Note: Students shall be trained to use computer to analysis the data, using available software's. However, during university examination students will use scientific calculators to analyse the data.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

FSC-411 Nursery Management of Horticultural Crops

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Principles of plant propagation. Seed dormancy and germination. Selection of rootstock and scion. Stock scion relationship. Factors affecting successful propagation. Physiology of dwarfing rootstock. Different methods of propagation like division, cutting, layering, budding and grafting, and tissue culture. Containers, media and mixtures. Propagation structures. Nursery act, quarantine and certification. Nutrient management and plant protection measures in nursery. Economics of raising fruit plant nursery.

Practical: Raising of rootstock. Methods to break seed dormancy. Propagation techniques. Training, lifting and packing of nursery plants. Preparation of media and mixtures, and raising nursery in poly bags. Project formulation and valuation of nursery raising.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-I

FSC-412 **Fundamentals of Fruit Production**

Time: 3 Hours **Max. Marks: 100**
Theory: 80
Internal assessment 20
Periods per Week: 4+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Climatic classification of fruits in Punjab & India. Climate as a limiting factor in Horticulture, Principles of orchard planning, selection of site for establishing an orchard. Winter killing and hardiness. Protection of fruit against adverse climatic conditions. Water requirement of fruit crops and factors influencing it. Critical period of water supply, wilting point, wilting co-efficient and wilting of fruit plants under field conditions. Factors influencing rate of transpiration and moisture absorption. The response of fruits plants to varying conditions of soil moisture and humidity. Influence on new shoot formation, vegetative growth, yield and fruit development and cropping time and method of irrigation. Orchard soil management methods. Their relation to moisture conservation and nutrient supply. Different types of soils. Nutrients and their availability. Soil improvement and maintenance of organic matter in the soil. Macro and micro elements. Detection of nutrient deficiency in the orchards. Method and time of application, Role of different elements in Horticulture.

Problems of pollination and fruit set. Factors associated with fruit setting and development of fruits.(Internal & External factors). Role of growth regulators in fruit set, fruit development and maturity of fruits.

Pollen viability and germination; stigma receptivity and pollination studies in fruits.

Practical:

Nomenclature and identification of fruit plants, Planning and layout of an orchard, Planting of an orchard, Study of different methods of irrigation of fruit crops, Calculate water requirement of fruit crops, Study of different cultural practices adopted in the orchards, Weeds and their management in fruit crops, Protection of fruit plants against adverse weather conditions, Manuring and fertilization of fruit crops, Identification and management of nutritional deficiencies in fruit crops, Collection of soil and leaf samples for diagnosis of nutritional deficiencies, Study of bearing habits of fruits, Types of inflorescence in fruit crops, Role of growth regulators in fruit plants.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

FSC-521: Sub-Tropical and Temperate Fruit Production

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Origin, distribution, commercial importance and export potential. Ecophysiological requirements. Species and varieties. Rootstocks and propagation. Planting, root zone, training and pruning. Nutrition and water requirements, fertigation, role of bio- regulators, major pests, diseases, physiological disorders and their control measures. Abiotic factors limiting fruit production. Flowering, pollination and fruit set. Quality improvement. Storage and ripening techniques. Industrial and export potential, Agri. Export Zones (AEZ) and industrial support. Fruit crops-Apple, pear, quince, grapes, plum, peach, apricot, cherries, hazelnut, litchi, loquat, persimmon, kiwifruit, strawberry, walnut, almond, pistachio, pecan, mangosteen, carambola, bael, wood apple, fig, jamun, rambutan and pomegranate.

Practical: **Time: 3 Hours**

Description and identification of species and varieties. Growth and development. Growth regulation. Nutritional and physiological disorders and their control. Rejuvenation of old and unproductive trees. Visit to commercial orchards. Project preparation for establishing commercial orchards.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

FSC-522: Breeding of Fruit Crops

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Origin and distribution, taxonomical status of species and cultivars. Cytogenetics and genetic resources. Blossom biology, breeding objectives, systems and ideotypes. Crop improvement through introduction, selection, hybridization, mutation breeding, polyploid breeding and rootstock breeding. Improvement of quality traits. Resistance breeding for biotic and abiotic stresses. Biotechnological interventions, achievements and future thrusts in the following selected crops.

Crops: Mango, banana, citrus, grapes, guava, papaya, amla, ber, litchi, jamun, phalsa, apple, pear, peach, plum, almond and strawberry.

Practical: **Time: 3 Hours**

Characterization of germplasm. Blossom biology and anthesis. Estimating fertility status. Practices in hybridization, ploidy breeding, mutation breeding, evaluation of biometrical and quality traits. Screening for resistance, developing breeding programme for specific traits. Visit to research stations.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

FSC-523: Post Harvest Technology of Fruit Crops

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Importance and scope. Maturity indices, harvesting practices and grading for specific market requirements. Influence of pre-harvest practices, enzymatic and textural changes, respiration and transpiration. Physiology and biochemistry of fruit ripening, ethylene evolution and its management. Pre-cooling. Factors leading to post-harvest losses. Treatments prior to transportation viz. chlorination, waxing, chemicals, bio-control agents, natural plant products fungicides, hot-water, vapour heat treatment, sulphur fumigation and irradiation. Methods of storage. Physical injuries and. disorders during storage. Packing methods and transport. Quality evaluation.

Practical: **Time: 3 Hours**

Analyzing maturity stages of commercially important fruit crops, harvesting methods, pre-cooling methods, grading. Pre-harvest and post-harvest application of growth substances, fungicides, nutrients, waxes and hot water treatments, sulphuring. Improved packing and storage of important horticultural commodities. Physiological loss in weight of fruits. Estimation of transpiration, respiration rate, ethylene release. Estimation of quality characteristics in stored fruits. Cold chain management – visit to cold storage and CA storage units.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

SSC-420: Soil Fertility and Fertilizer Use (Minor)

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Plant growth – factors affecting, growth equations; Plant nutrients-functions, deficiency symptoms;, content and distribution in soils; Nutrient toxicities nutrient transformations, retention and availability; Nutrient interactions; Nutrient removal by crops; Methods of soil fertility evaluation; Maintenance of soil fertility; Fertilizers and their fate in soils; Crop responses to fertilizers; Fertilizer use efficiency; Principles of time and mode of fertilizer application; integrated use of fertilizers and manures; Nutrient release and carry -over effects; Current fertilizer production and consumption, future trends and needs in India.

Practical: **Time: 3 Hours**

Analysis of soils for different forms of nitrogen, phosphorus, potassium and sulphur; Determination of DTPA extractable micronutrients; Plant analysis for nitrogen, phosphorus, potassium, calcium, magnesium and sulphur; Diagnosis and management of nutrient deficiencies and toxicities.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

PBG-420 Principles of Seed Production (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Importance of Seed production, Certified, foundation and breeder seed production. Maintenance of genetic purity. Seed quality and classes of seed, maintenance and multiplication of pre-release and newly released varieties of self and cross pollinated crops. Seed production in tomato, brinzal, onion, bottle guard, and ridge gourd. Seed certification. Seed Act and its enforcement. Intellectual property rights, patenting, WTO, plant breeder rights. Principles and methods of seed drying. Seed processing. Planning and layout seed processing plant. Different upgrading equipments and their use. Seed testing procedures for quality assessment. Seed treatment and its importance. Seed packing and storage. Seed marketing and organizational setup.

Practical: **Time: 3 Hours**

Seed sampling principles and procedures. Determination of physical purity, germination, moisture, vibility, seed health, seed vigour of crops. Seed dormancy and breaking methods. Visit to seed production plots testing laboratories and hybrid seed production farms.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

STA-425: Experimental Designs for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

Theory

Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data, completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions, orthogonality and partitioning of degrees of freedom confounding in 2^3 , 2^4 and 3^3 designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments; Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

Practical: **Time: 3 Hours**

cross over and balanced incomplete block designs.

Note: Students shall be trained to use computer to analysis the data, using available software's. However, during university examination students are allowed to use scientific calculators to analysis is the data.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

***FSC-421 Commercial Fruit Production**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties, horti-agri techniques, production, plant protection measures and special problems in fruits such as citrus, mango, guava, apple, pear, peach, plum, ber, litchi, grapes, pomegranate, papaya, pineapple, phalsa, banana and sapota.

Practical: Identification of species and fruit varieties, training and pruning, maturity standards, harvesting, handling, grading and packing of fruits. Project formulation and valuation of orchard management.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-II

***FSC-422 Processing and Value Addition of Horticultural Crops**

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 20
Internal assessment 15+5=20
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Scope of fruit preservation industry in India, present status, constraints and prospects. Importance, principles and practices of fruit processing. Maturity indices, harvesting, transportation and quality parameters of fruits. Pre and post harvest factors affecting processing quality of fruits. Commercial processing technologies for fruits like mango, citrus, guava, grapes, ber, apple, pear, peach, plum, phalsa, litchi, pomegranate and papaya etc. Packing technology for export and value addition.

Practical:

Judging of maturity of different fruits. Methods of preparation of jam, jelly, ready to serve, squash, nectar, canning, chutney, pickle and marmalade etc. Packing technologies. Drying and dehydration of fruits. Visit to local processing unit.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

FSC-531: Principles and Practices of Plant Propagation.

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Introduction, life cycles in plants, cellular basis for propagation. Sexual propagationapomixis, polyembryony, chimeras. Factors influencing seed germination, hormonal regulation of germination and seedling growth. Seed quality, treatment, packing, storage, certification and testing. Rooting of cuttings under mist and hot beds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Selection of elite mother plants. Establishment of bud wood bank. Stock, scion and inter stock relationship and Incompatibility. Physiology of dwarfing rootstocks. Rejuvenation. Progeny orchard and scion bank. Micro-propagation - in vitro clonal propagation, direct organogenesis, embryogenesis, micrografting and Meristem culture. Hardening, packing and transport of micro-propagules. Nursery structures.

Practical: **Time: 3 Hours**

Anatomical studies in rooting of cutting and graft union. Propagation structures. Use of media and PGR. Micropropagation and hardening of plants. Explant preparation, media preparation, culturing in vitro, clonal propagation, meristem culture, shoot tip culture, axillary bud culture., Micro grafting and hardening. Visit to TC labs and nurseries.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

FSC-532.: Plant Growth Regulators in Fruit Crops

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the paper setters:

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3. Not more than one question should be based on one topic.
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5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

History, nomenclature, role and physiological effects of plant growth regulators in fruit crops; Methods of application of growth regulators; Methods of isolation and estimation; Mechanism of action; Role of plant regulators in plant propagation, seed dormancy, apical dominance, rooting of cutting, flower initiation, fruit set and fruit development; flower and fruit thinning, parthenocarpy, fruit drop and induced fruit abscission, fruit ripening and quality improvement in fruit crops.

Practical:

Preparation of growth regulator solutions; Methods of application; Application in plant propagation, prevention of flower and fruit drop; induction of parthenocarpy, fruit set, fruit thinning, fruit ripening and quality improvement; Isolation and bioassys for the estimation of plant regulators.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

SSC-430 **Fertilizer Technology (Minor)**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

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4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Fertilizer industry in India; Raw materials; Manufacture of different types of fertilizers including reactions and flow diagrams; Granulation, segregation, caking, drying and cooling of fertilizers; Complex, mixed, liquid, suspension and slow release fertilizers; Production of fertilizers containing secondary and micronutrients; Changing trends in fertilizer technology.

Practical:

Collection of soil and fertilizer samples; Preparation of standard solutions. Colorimetric and flame photometric methods; Analysis of soil for fertilizer recommendations and suitability for orchard plantation; Gypsum and lime requirements of soil; Analysis of fertilizer for quality control; Planning and formulation of project on establishment of soil and fertilizer testing laboratories. Visit to fertilizer factories.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

PFE-430 **Protected Cultivation of Vegetables**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Objectives, Importance and scopes of protected cultivation; Principles used in protected cultivation; Regulatory structures/ glass houses; Effect of different factors such as temperature,light,CO_2 and humidity on growth of different vegetables; fertigation, nursery raising under protected structures like poly tunnels; Types of green house, glass houses, hot beds ,cold frames , poly houses; Different media for growing nursery under cover; Specific technology for raising tomato, sweet pepper, cucumber and other vegetables in green house; Insect and disease management in green house; Economics of protected cultivation; Types of benches and containers, training and staking in green house; Soil less culture, (hydroponics) ; Manipulation of CO_2 , light and temperature for timing vegetable crop production; Problems of growing vegetables under green house and their remedies; Suitability of crops and varieties/ Genotypes for growing under green house and poly houses ; Use of glass/green house for seed production; Practical use of growing vegetables under forced conditions.

Practical:

Study of various types of structures, methods to control temperature, CO_2, light, demonstration for sanitation, media hydroponics, maintenance of parental lines and hybrid seed production in the glass house, fertigation and nutrient management control of disease and insect pest in glass house; visit to established green houses in the region.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

BOT-430 Physiology of Growth and Development

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

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4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Concepts of growth, differentiation and pattern formation; growth curves, meristems, growth kinetics, factors affecting growth and general aspects of development, level of differentiation, control of development at genetic level. Hormones and growth regulators - auxins, gibberellins, cytokinins, ethylene, ABA, other inhibitors, retardants, polyamines, aliphatic alcohols, brassins, hormonal regulation of growth and development, plant movements; photoperiodism, phytochrome, flowering hormones, vernalization, abscission, ageing, senescence; physiology of seed and fruit development; seed germination; seed and bud dormancy. Plant physiology and agriculture.

Practical:

Experiments on growth measurements, hormonal bioassays, plant movements; experiments on quality of light on seed germination, breaking of dormancy. Experiments on photoperiodism. Experiments on hormonal regulation of development.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-III

CREDIT SEMINAR

Total Marks: 100
Periods per week: 03

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-IV

FSC-541: Citriculture

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 20
Internal assessment 15+5=20
Periods per week :4+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Origin, distribution and commercial importance: Important cultivated species and varieties: Propagation and rootstocks climatic and soil requirements: Training and pruning: Intercropping and weed control. Fertilization and irrigation: Physiological and pathological disorder and their control: Harvesting and handling of fruits.

Practical: **Time: 3 Hours**

Description and identification of different citrus species and cultivars: Training and pruning: study of various stionic combinations: identification of rootstocks through chemical test: weed control: control of fruit drop: nutritional disorders: Quality analysis: fertilization and irrigation.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-IV

FSC-542: Orchard Floor Management and Organic Agriculture

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 20
Internal assessment 15+5=20
Periods per week : 04+3

Instructions for the Paper Setters:

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2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Soil quality and its management for orchard plantation. Effect of soil organic matter on physic-chemical characteristics of the soil. Moisture conservation and water requirement for fruit crops. Principles, methods and scheduling of irrigation. Principles and status of organic horticulture. Organic farming systems. Organic inputs and their role. EM technology and its impact. Indigenous practices of sustainable soil fertility, weed management and biological/natural control of pests and diseases. Fruit quality improvement. Good Agricultural Practices (GAP), HACCP and certification of organic products. Standards evolved by different agencies. Constraints in certification, organic horticulture and export.

Practical:

Different methods of irrigation. Mulching and weed control in orchards. Determination of soil organic matter. Inter-cropping exercise. Input analysis of manures. Bio-composting, biofertilizers and their application. Methods of preparation of organic manures. EM technology and products. Biological/natural control of pests and diseases. Soil solarization. Case studies. Residue analysis in organic products and documentation.

M.Sc. AGRICULTURE
(FRUIT SCIENCE)

SEMESTER-IV

RESEARCH WORK

Total Marks: 250
Periods per week: 04

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
SSC-511	Soil Physics	4	3	80	40	20	10	100	50	150
SSC-512	Soil Fertility and Fertilizer use	4	6	80	40	20	10	100	50	150
SSC-513	Soil Chemistry	4	3	80	40	20	10	100	50	150
AGR- 410 (Minor)	Crop Ecology	4	6	80	40	20	10	100	50	150
STA-415	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
*SSC-413	Analytical Techniques in Soils, Plants, Fertilizers and Water									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
SSC-521	Soil Mineralogy, Genesis, Classification and Survey	4	3	80	40	20	10	100	50	150
SSC-522	Soil Biology and Biochemistry	4	6	80	40	20	10	100	50	150
SSC-523	Soil Erosion and Conservation	4	3	80	40	20	10	100	50	150
AGR-420 (Minor)	Farm Cropping System	4	6	80	40	20	10	100	50	150
STA-425	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
*SSC-422	Soil Physical and Biological Environment									NC
*SSC-423	Soil Survey, Classification and Mapping									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Prac**	**Th.**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	
SSC-531	Soil,Water and Air Pollution	4	3	80	40	20	10	100	50	150
SSC-532	Analytical Techniques and Instrumental Methods	4	6	80	40	20	10	100	50	150
SSC-430 / AGM-430// BOT-430 (Minor)	Fertilizer Technology / / Fundamentals of Agroclimatology/ Physiology of Growth & Development	4	3	80	40	20	10	100	50	150
	Credit seminar	3		100				100		100
	Research Work (Four periods per Teacher per Student)	-	4							
Total		**15**	**16**	**340**	**120**	**60**	**30**	**400**	**150**	**550**

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-IV

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal assessment**		**Total Marks**		**Grand Total**
		Th.	**Pract.**	**Th.**	**Pract.**	**Th.**	**Prac**	**Th**	**Prac**	
SSC-541	Management of Problem Soils and Water	4	3	60	20	15	05	75	25	100
SSC-542	System Approaches in Soil and Crop Studies	4	0	80		20		100		100
	Research Work (Four Periods per Teacher Per Student)		4		250				250	250
	Total	**08**	**07**	**140**	**270**	**35**	**05**	**175**	**275**	**450**

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

SSC-511 **Soil Physics**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters

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3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Soil physical behavior. Soil consistence. Dispersion and workability of soils. Soil compaction and consolidation. Soil strength-bulk density relations. Swelling and shrinkage-basic concepts. Soil structure165 genesis, characterization and management. Soil tilth. Soil crusting - mechanism, factors affecting and evaluation. Soil conditioners. Puddling, its effect on soil physical properties. Soil water - retention, constants. Energy state of soil water, soil-moisture characteristics. Hysteresis. Water flow in saturated and unsaturated soils, Darcy's law, hydraulic conductivity, permeability. Infiltration, internal drainage and redistribution. Evaporation. Hydrologic cycle, field water balance. Soil-plant-atmosphere continuum. Composition, renewal and measurement of soil air. Aeration requirement for plant growth. Modes of energy transfer in soils, energy balance, thermal properties of soil. Soil temperature in relation to plant growth.

Practical:

Mechanical analysis of soil. Measurement of Atterberg limits. Aggregate analysis. Measurement of soil-water content. Measurement of soil-water potential. Determination of soil-moisture characteristics curve and computation of pore-size distribution. Determination of hydraulic conductivity under saturated and unsaturated conditions. Determination of infiltration rate of soil. Determination of aeration porosity and oxygen diffusion rate. Soil temperature measurements.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

SSC-512 **Soil Fertility and Fertilizer Use**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Soil fertility and soil productivity. Nutrient sources - fertilizers and manures. Soil N - sources and N transformations. Biological nitrogen fixation. Nitrogenous fertilizers - their fate in soils and enhancing N use efficiency. Soil P - forms, reactions in soils and factors affecting availability. Management of P fertilizers. Potassium- forms, mechanism of fixation, Q/I relationships. Management of K fertilizers. Sulphur, Ca and Mg - source, forms, fertilizers and their behavior in soils and management. Micronutrients- critical limits in soils and plants, factors affecting their availability, sources and management. Common soil test methods for fertilizer recommendations. Site-specific and plant need based nutrient management. Integrated nutrient management. Blanket fertilizer recommendations- usefulness and limitations. Soil fertility evaluation. Soil quality in relation to sustainable agriculture.

Practical:

Laboratory and greenhouse experiments for evaluation of indices of nutrient availability and their critical values in soils and plants. Chemical analysis of soil for total and available nutrients. Analysis of plants for essential elements.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

SSC-513 **Soil Chemistry**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Chemical composition of earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. Inorganic and organic colloids-surface charge characteristics, diffuse double layer theories, zeta potential stability, coagulation/ flocculation, peptization, electrometric and sorption properties of soil colloid. Soil organic matter-fractionation, clay-organic interactions. Cation exchange-theories, adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, anion and ligand exchange inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption desorption of oxy-anions and anions. Experimental methods to study ion exchange phenomena and practical implications in plant nutrition. Potassium, phosphate and ammonium fixation in soils and management aspects. Chemistry of acid, salt-affected and submerged soils and management aspects.

Practical:

Analysis of equilibrium soil solution for electrochemical properties. Determination of point of zero-charge and associated surface charge characteristics. Potentiometric and conductometric titration of soil humic and fulvic acids. E4/E6 ratio of soil humic and fulvic acids. Adsorption-desorption of phosphate/ sulphate. Construction of adsorption envelop of soils by using phosphate/fluoride/sulphate and ascertaining the mechanism of the ligand exchange process involved. Determination of titratable acidity of an acid soil.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

AGR-410 **Crop Ecology (Minor)**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:
1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory
Ecology in relation to crop; Eco system- components and energy flow- food chain and energy output relationships; Agro- ecosystem and agro-ecological zones of India; Efficient food producing systems; Farming system of the world-arable, pastoral, lay farming, shifting cultivation, ranching and agro-forestry systems, energy and fuel, wood plantations; Specialized and diversified forming; Family, co-operative and collective farming, their occurrence and adaptation and weakness; Cropping systems, their characteristics and management; Cropping patterns; Farm selection , size of the farm and farm layout, cropping schemes and crop plans ; Solar radiation concepts, laws and their absorption in crop system; Bio-geo-chemical cycle and their significance.

Practical: **Time: 3 Hours**

Analysis of crop ecosystem components; Light measurement in pure and mixed crop stands; Modification in crop environment; Measuring temperature, light and moisture effects: Preparation of farm lay out plans, different intensity crop rotations and cropping schemes; Estimating crop yields; Energy budgeting in different crops and cropping systems; Working out ecological optimum crop zones.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

STA-415: Statistical Methods for Research Workers

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Probability and fitting of standard frequency distributions, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intraclass correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal call frequencies, transformation of data.

Practical:

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-I

***SSC-413 Analytical Techniques in Soils, Plants, Fertilizers and Water**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Colorimetric and flame photometric methods. Atomic absorption spectrophotometery. Cation and anion exchange phenomenon and their importance. Ion adsorption, desorption and fixation in soils. Methods ofsoil fertility evaluation. Fertilizer control order. Acid, saline, sodic, calcareous soils and their amelioration. Planning and formulation of project on establishment of soil water and plant testing laboratory.

Practical:

Preparation of standard solutions. Collection of soil, water, plant and fertilizer samples. Analysis of soil samples for fertility and quality evaluation for field crops and orchard plantations. Analysis of irrigation water for quality appraisal. Fertilizers analysis for quality control. Soil, water and fertilizer analysis reports for recommendation purposes. Analysis of forms of nitrogen , phosphorous, potassium and sulphur in soils. Determination of DTPA-extractable micronutrients. Plant analysis for total N, P, K andmicro-nutrients. Determination of CEC and AEC of soils. Nutrient adsorption and fixation capacities of soils.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

SSC-521 Soil Mineralogy, Genesis, Classification and Survey

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism. Classification, structure, chemical composition and properties of clay minerals. Genesis and transformation of crystalline clay minerals. Amorphous soil constituents and other non-crystalline silicate minerals. Clay minerals in Indian soils. Soil formation - factors, models, processes. Weathering of rocks and mineral transformations. Soil profile. Soil classification systems - historical developments and modern systems of soil classification. Soil survey- types, techniques. Soil series- characterization and procedure for establishing soil series, benchmark soils and soil correlations. Soil survey interpretations. Techniques for generation of soil maps. Landform- soil relationship, major soil groups of India with special reference166 to respective states. Land capability and land irrigability classification. Land evaluation and land use type. Approaches for managing soils and landscapes in the framework of agro-ecosystem.

Practical:

Identification and quantification of minerals in soils. Morphological properties of soil profile in different landforms. Classification of weathering indices and its application in soil formation. Grouping soils using available data base in terms of soil quality. Cartographic techniques for preparation of maps, processing of field sheets, compilation and obstruction of maps in different scales. Land use planning exercises using conventional and RS tools

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

SSC-522 **Soil Biology and Biochemistry**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Soil biota, soil microbial ecology, types of organisms. Soil microbial biomass, microbial interactions, un-culturable soil biota. Microbiology and biochemistry of root-soil interface. Phyllosphere. Soil enzymes, origin, activities and importance. Soil characteristics influencing growth and activity of microflora. Microbial transformations of N, P, S, Fe and Mn 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 organic manures, rural and urban composts and vermicompost. Biofertilizers - definition, classification, specifications, method of production and role in crop production.

Practical:

Determination of soil microbial population. Soil microbial biomass. Elemental composition, fractionation of organic matter and functional groups. Decomposition of organic matter in soil. Soil enzymes. Measurement of important soil microbial processes such as ammonification, nitrification, N_2 fixation, S oxidation, P solubilization and mineralization of other micro nutrients. Study of rhizosphere effect.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

SSC-523 **Soil Erosion and Conservation**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

History, distribution, identification and description of soil erosion problems in India. Soil erosion by water factors and mechanism. Raindrops and soil erosion. Rainfall erosivity - estimation of erosivity indices. Soil erosion in relation to soil properties. Wind erosion- factors affecting, extent of problem. Principles and practices of erosion control. Soil conservation planning in hilly, arid and semi-arid regions, waterlogged and wet lands. Type, factors and processes of soil/land degradation and its impact on soil productivity. Watershed management. Water harvesting, recycling and flood control. Socio-economic aspects of watershed management. Case studies in respect to monitoring and evaluation of watersheds. Use of remote sensing in assessment and planning of watersheds.

Practical:

Determination of different soil erodibility indices- suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index. Computation of kinetic energy of falling rain drops. Computation of rainfall erosivity indices (EI30) using rain gauge data. Measurement and estimation of runoff and soil loss. Visits to soil and water conservation works.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

AGR-420: Farm Cropping System (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Farming systems-introductions terms and definitions ; Concept and its role in sustainability of agriculture; Factor effecting choice of farming system; Resource management in relation to farm cropping system; Crop yield appraisals; Plant interaction, criteria for assessing yield advantages ;Indices for evaluating productivity and efficiency; Agronomic consideration interaction in sequential cropping ; Evaluation and productivityof multiple cropping systems; Cropping systems in dry land farming; Cropping systems for irrigated areas; Cropping systems in high rainfall areas; Cropping systems with perennials; Introduction to agro forestry concept; Physiological and actual maturity of crop and criteria of crop harvest; Comparison of chemical and organic farming;

Practical: **Time: 3 Hours**

Visit to farming system and agro-based industries; Farm lay out plan, cropping scheme; Practical study of raising crops: Wheat, Rice, Maize Sugarcane, Groundnut, Toria, Gobi Sarson; Estimation of crop yield, calculation of harvest index, land equitant ratio in mixed crops/ intercrops.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

STA-425: Experimental Designs for Research Workers

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data, completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions, orthogonality and partitioning of degrees of freedom confounding in 2^3 , 2^4 and 3^3 designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments; Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

Practical:

Uniformity trials, completely randomized, randomized block and latin square designs, missing plot and analysis, of covariance, 2^3 ,2^4 and 3^3 simple and confounded experiments, split and strip plot designs, cross over and balanced incomplete block designs.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

***SSC-422 Soil Physical and Biological Environment**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Soil physical properties in relation to crop production. Soil thermal regime and its management. Soil air-composition, renewal, characterization of soil aeration in relation to plant growth. Movement of water in soil. Infiltration and redistribution of water in soil. Evaporation from soils and its management. Runoff from the agricultural fields and factors affecting. Soil organisms and their distribution, ecology, classification and activities in soil. Microbiological transformations of C, N and S in soils.

Practical:

Determination of dry and wet stability of aggregates. Measurement of in situ soil bulk density and filling of soil columns with a particular bulk density. Measurement of soil porosity. Determination of consistency limits of soils. Soil moisture characteristics. Measurement of soil temperature using thermocouples. Determination of infiltration rate under different surface conditions. In situ measurement of soil moisture by neutron probe and Time Domain Reflectrometry. In situ measurement of soil matric potentialusing tensiometers. Enumeration of soil bacteria, fungi and actinomycetes. Isolation of Rhizobiumand Azotobacter and measurement of respiration rate.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-II

***SSC-423 Soil Survey, Classification and Mapping**

Time: 3 Hours **Max. Marks: 50**
Practical: 40
Internal assessment =10
Periods per Week: 0+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Practical:

Application and use of global positioning system for soil survey. Macro-morphological study of soils. Classification of soils developed on different landforms. Study of base maps-cadastral maps, top sheets, aerial photographs and satellite imageries. Soil survey of project area-preparation of base maps, analysis of soil characteristics, classification of surveyed soils, mapping and report writing. Interpretation of soil survey data for land capability and crop suitability classifications. Use of geographical information system for preparing thematic maps

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

SSC-531 **Soil, Water and Air Pollution**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Soil, water and air pollution problems associated with agriculture. Nature and sources of pollutants their CPC standards and effect on plants, animals and human beings. Sewage and industrial effluents - their composition and effect on soil, plant growth and human beings. Soil as sink for waste disposal. Pesticides - their classification, behavior in soil and effect on soil micro-organisms. Toxic elements - their sources, behavior in soils, effect on nutrients availability and on plant and human health. Pollution of water resources. Emission of greenhouse gases. Remediation/amelioration of contaminated soil and water, remote sensing applications in monitoring and management of soil and water pollution to
safeguard food safety.

Practical:

Sampling of sewage waters and sludge, industrial wastes, polluted soils and plants. Estimation of dissolved and suspended solids, COD, BOD, nitrate and ammonical N and P, heavy metal content in effluents. Heavy metals in contaminated soils and plants. Air sampling and determination of particulate matter and oxides of S. Visit to various industrial sites to study the impact of pollutants on soil and plants.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

SSC-532 Analytical Techniques and Instrumental Methods

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Atomic structure. Radioisotopes-properties and decay principles. Principles and use of radiation monitoring instruments. Isotopic dilution techniques. Doses of radiation exposure, radiation safety aspects. Storage and handling of radioactive materials. Principles of visible, ultraviolet and infrared spectrophotometery, inductively coupled plasma spectrometry, chromatographic techniques, mass spectrometry and X-ray defractrometery.

Practical:

Oxidation-reduction and complexo-metrictitration. Soil, water and plant sampling techniques, their processing and handling. Determination of nutrient potentials and potential buffering capacities of soils for P and K. Identification of minerals by different methods. Electrochemical titration of clay. Estimation of root CEC. Analysis of soil and plant samples for N, P, K, Ca, Mg, S, Zn, Cu, Fe, Mn, B and Mo. Analysis of plant materials by digesting plant material by wet and dry ashing and soil by wet digestion methods. Drawing normalized exchange isotherms. Measurement of redox potential. Preparation of soil and plant samples for radioactive measurements. Determination of half life and decay constant.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

SSC-430 **Fertilizer Technology (Minor)**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Fertilizer industry in India; Raw materials; Manufacture of different types of fertilizers including reactions and flow diagrams; Granulation, segregation, caking, drying and cooling of fertilizers; Complex, mixed, liquid, suspension and slow release fertilizers; Production of fertilizers containing secondary and micronutrients; Changing trends in fertilizer technology.

Practical:

Collection of soil and fertilizer samples; Preparation of standard solutions. Colorimetric and flame photometric methods; Analysis of soil for fertilizer recommendations and suitability for orchard plantation; Gypsum and lime requirements of soil; Analysis of fertilizer for quality control; Planning and formulation of project on establishment of soil and fertilizer testing laboratories. Visit to fertilizer factories.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

AGM-430 Fundamentals of Agroclimatology (Minor)

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Survey of the atmosphere; introduction to basic meteorological processes; nature, receipt and disposal of solar radiation; Atmospheric humidity and forms condensation; Evaporation and evapotranspiration ; Winds, air masses and disturbance ;influence of climate on plants, animals and pests; Meterological droughts; indices in agroclimatrology ; Agroclimatic classifications and their application; field climate modification.

Practical:

Meteorological instruments and their use in the measurement of agroclimatic environment; Measurement of field climate; Computation of agroclimatic indices-GDD, PTU, PET etc; Determining crop production sensitivity to weather.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

BOT-430 **Physiology of Growth and Development**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Concepts of growth, differentiation and pattern formation; growth curves, meristems, growth kinetics, factors affecting growth and general aspects of development, level of differentiation, control of development at genetic level. Hormones and growth regulators - auxins, gibberellins, cytokinins, ethylene, ABA, other inhibitors, retardants, polyamines, aliphatic alcohols, brassins, hormonal regulation of growth and development, plant movements; photoperiodism, phytochrome, flowering hormones, vernalization, abscission, ageing, senescence; physiology of seed and fruit development; seed germination; seed and bud dormancy. Plant physiology and agriculture.

Practical:

Experiments on growth measurements, hormonal bioassays, plant movements; experiments on quality of light on seed germination, breaking of dormancy. Experiments on photoperiodism. Experiments on hormonal regulation of development.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-III

CREDIT SEMINAR

Total Marks: 100
Periods per week: 03

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-IV

SSC-541 Management of Problem Soils and Water

Time: 3 Hours **Max. Marks: 100**

Theory: 60

Practical: 20

Internal Assessment15+5==20

Periods per week :4+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Area, distribution, origin and basic concepts of problematic soils. Morphological features and characterization of salt-affected soils. Management of salt- affected soils. Salt tolerance of crops - mechanism and ratings. Monitoring of soil salinity in the field. Management principles for sandy, clayey, red lateritic and dry land soils. Acid soils - nature, sources and management, effect on plant growth. Lime requirement of acid soils. Biological sickness of soils and its management. Quality of irrigation water, management of brackish water. Salt balance under irrigation. Characterization of brackish waters, area and extent. Agronomic practices in relation to problematic soils. Cropping pattern for utilizing poor quality ground waters.

Practical:

Characterization of acid, acid sulfate, salt- affected and calcareous soils. Determination of cations (Na+, K+, Ca+, and Mg++) in ground water and soil samples. Determination of anions (CI^-, SO^{2-}_4, CO^{2-}_3 and HCO^-_3) in ground waters and soil samples. Lime and gypsum requirement of acid and sodic soil.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-IV

SSC-542 System Approaches in Soil and Crop Studies

Time: 3 Hours **Max. Marks: 100**

Theory: 80

Internal Assessment=20

Periods per week :04

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Systems concepts- definitions, general characteristics, general systems theory. Systems - thinking, dynamics, behavior and study. Model - definition and types. Mathematical models and their types. Modeling concepts, objectives, processes, abstraction techniques. Simulation models, their verification and validation, calibration. Representation of continuous systems simulation models- procedural and declarative. Simulation meaning and threats, experiment, design and analysis. Application of simulation models in understanding system behavior, optimizing system performance, evolution of policy options under different soil, water, and nutrient, climatic and cultural conditions. Decision support system, use of simulation models in decision support system.

M.Sc. AGRICULTURE
(SOIL SCIENCE)

SEMESTER-IV

RESEARCH WORK

Total Marks: 250
Periods per week: 04

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-I

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Pract.**	**Th.**	**Pract.**	**Th.**	**Pract.**	**Th.**	**Pract.**	
VSC-511	Production Technology of Warm Season Vegetable Crops	4	3	80	40	20	10	100	50	150
VSC-512	Growth & Development of Vegetable Crops	4	6	80	40	20	10	100	50	150
VSC-513	Systematics of Vegetable Crops	4	3	80	40	20	10	100	50	150
SSC- 410 (Minor)	Soil Chemistry and Bio Chemistry	4	6	80	40	20	10	100	50	150
STA-415	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
*VSC-413	Commercial Vegetable Production									NC
*VSC-414	Vegetable Breeding and Seed Production									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

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SEMESTER-II

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
VSC-521	Production Technology of Cool Season Vegetable Crops	4	3	80	40	20	10	100	50	150
VSC-522	Breeding of Vegetable Crops	4	6	80	40	20	10	100	50	150
VSC-523	Production Technology of Underexploited Vegetable Crops	4	3	80	40	20	10	100	50	150
SSC-420/ PBG-420 (Minor)	Soil Fertility and Fertilizer Use/Principles of seed Production	4	6	80	40	20	10	100	50	150
STA-425	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
*VSC-423	Forcing Techniques in Vegetable Production									NC
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

*Note: The students from the stream other than they opted for Post Graduate classes will have to clear UG course of Elective subject with UG classes as per schedule.

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SEMESTER-III

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Prac**	**Th.**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	
VSC-531	Fundamentals of Processing of Vegetables	4	3	80	40	20	10	100	50	150
VSC-532	Protected Cultivation of Vegetable Crops	4	6	80	40	20	10	100	50	150
SSC-430 / AGM-430// BOT-430 (Minor)	Fertilizer Technology / / Fundamentals of Agroclimatology/ Physiology of Growth & Development	4	3	80	40	20	10	100	50	150
	Credit seminar	3		100				100		100
	Research Work (Four periods per Teacher per Student)	-	4							
Total		**15**	**16**	**340**	**120**	**60**	**30**	**400**	**150**	**550**

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SEMESTER-IV

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Prac	Th	Prac	
1	VSC-541	Seed Certification, Processing and Storage of Vegetable Crops	4	3	60	20	15	05	75	25	100
2.	VSC-542	Organic Vegetable Production Technology	4	3	60	20	15	05	75	25	100
3		Research Work (Four Periods per Teacher Per Student)		4		250				250	250
		Total	**08**	**07**	**120**	**290**	**30**	**10**	**150**	**300**	**450**

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SEMESTER-I

VSC-511 Production Technology of Warm Season Vegetable Crops

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

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

UNIT I

Tomato, eggplant, hot and sweet peppers

UNIT II

Okra, beans, cowpea and clusterbean

UNIT III

Cucurbitaceous crops

UNIT IV

Tapioca and sweet potato

UNIT V

Green leafy warm season vegetables

Practical:

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

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SEMESTER-I

VSC-512 Growth And Development Of Vegetable Crops

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

UNIT I

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

UNIT II

Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellilns, cyktokinins 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.

UNIT III

Role of light, temperature and photoperiod on growth, development of underground parts, flowering and sex expression in vegetable crops; apical dominance.

UNIT IV

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.

UNIT V

Plant growth regulators in relation to vegetable production; morphogenesis and tissue culture techniques in vegetable crops.

Practical:

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

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SEMESTER-I

VSC-513 **Systematics Of Vegetable Crops**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical:

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

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SEMESTER-I

SSC-410 Soil Chemistry and Bio Chemistry (Minor)

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week: 04+06

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Soil colloids–nature, properties, origin of charges and their significance; Cation and anion exchange phenomena and their importance; Introduction to ionic adsorption and fixation; Soil reaction and buffering; Distribution, characterization, genesis and amelioration of acid, acid sulphate, saline, saline-sodic, sodic and calcareous soils; Plant reaction and tolerance to soil salinity, sodicity and acidity; Chemical and electro chemical properties of submerged soils; Organic matter and characterization of clay –organic matter interaction ; Biochemical decomposition of organic manures and farm wastes, composting and vermicomposting .Biochemistry of humus formation and biogas production .

Practical:

Determination of the effect of dilution and salinity on soil pH; Active and potential acidity; Cation and anion exchange capacity and exchangeable cations; Soluble salts in soils; Lime and gypsum requirements. Nutrient adsorption and fixation capacities of soils; Estimation of biochemical constituents of organic residues- cellulose, hemi-cellulose, lignin and C: N ratio. Preparation of enriched compost, biofertilizers and vermiculture.

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SEMESTER-I

STA-415: Statistical Methods for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

Theory

Probability and fitting of standard frequency distributions, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intraclass correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal call frequencies, transformation of data.

Practical:

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Note: Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students are allowed to use scientific calculators to analysis is the data.

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SEMESTER-I

***VSC-413 Commercial Vegetable Production**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Role of soil, climatic and agronomic factors in vegetable production. Principles of cultivation including direct sowing, nursery management, transplanting, hardening of seedlings and vegetable forcing. Weeds and their control. Rotation and Intercropping in vegetable crops. Export potentiality, postharvest handling, processing, storage and marketing of vegetables.

Practical:

Sowing and transplanting of vegetable crops. Effect of soil conditions on seedling emergence and plant growth. Nutrient deficiency symptoms. Common weeds, their identification and control. Project formulation and evaluation for vegetable nursery production and vegetable forcing techniques.

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SEMESTER-I

***VSC-414 Vegetable Breeding and Seed Production**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Scope of vegetable breeding and seed production. Origin, floral biology and breeding systems in vegetable crops. Germplasm resources. Principles and methods of breeding self-pollinated, often cross-pollinated and cross- pollinated vegetable crops. Plant introduction, selection, hybridization, population improvement, mutation and polyploidy. Seed production of conventional varieties. Production of F1 hybrids using male sterility, self-incompatibility, various sex-forms etc. Methods of production of nucleus, breeder, foundation and certified seeds isolation, pollination, seed harvesting, processing and storage. Seed testing and certification. Seed Act. Vegetable seed industry and its problems.

Practical:

Study of inflorescence and flower structures. Practice in emasculation and artificial pollination. Inspection and rouging. Testing of seeds for purity and germination. Project formulation and evaluation for seed production of vegetable crops.

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SEMESTER-II

VSC-521 Production Technology of Cool Season Vegetable Crops

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Introduction, botany and taxonomy, climatic and soil requirements, commercial arieties/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 productionof:

UNIT I

Potato

UNIT II

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

UNIT III

Root crops: carrot, radish, turnip and beetroot

UNIT IV

Bulb crops: onion and garlic

UNIT V

Peas and broad bean, green leafy cool season vegetables

Practical:

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

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SEMESTER-II

VSC-522 **Breeding Of Vegetable Crops**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:
1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:
Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives,breeding methods introduction, selection, hybridization, mutation), varieties and varietal characterization, esistance 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.

UNIT I
Potato and tomato

UNIT II
Eggplant, hot pepper, sweet pepper and okra

UNIT III
Peas and beans, amaranth, chenopods and lettuce

UNIT IV
Gourds, melons, pumpkins and squashes

UNIT V
Cabbage, cauliflower, carrot, beetroot, radish, sweet potato and tapioca

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

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SEMESTER-II

VSC-523 Production Technology of Underexploited Vegetables Crops

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week: 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

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

UNIT I

Asparagus, artichoke and leek

UNIT II

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

UNIT III

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

UNIT IV

Elephant foot yam, lima bean, winged bean, vegetable pigeon pea, jack bean and sword bean.

UNIT V

Sweet gourd, spine gourd, pointed gourd, Oriental pickling melon and little gourd (kundru).

Practical:

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

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SEMESTER-II

SSC-420 Soil Fertility and Fertilizer Use (Minor)

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Plant growth – factors affecting, growth equations; Plant nutrients-functions, deficiency symptoms;, content and distribution in soils; Nutrient toxicities nutrient transformations, retention and availability; Nutrient interactions; Nutrient removal by crops; Methods of soil fertility evaluation; Maintenance of soil fertility; Fertilizers and their fate in soils; Crop responses to fertilizers; Fertilizer use efficiency; Principles of time and mode of fertilizer application; integrated use of fertilizers and manures; Nutrient release and carry -over effects; Current fertilizer production and consumption, future trends and needs in India.

Practical:

Analysis of soils for different forms of nitrogen, phosphorus, potassium and sulphur; Determination of DTPA extractable micronutrients; Plant analysis for nitrogen, phosphorus, potassium, calcium, magnesium and sulphur; Diagnosis and management of nutrient deficiencies and toxicities.

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SEMESTER-II

PBG-420 Principles of Seed Production (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Importance of Seed production, Certified, foundation and breeder seed production. Maintenance of genetic purity. Seed quality and classes of seed, maintenance and multiplication of pre-release and newly released varieties of self and cross pollinated crops. Seed production in tomato, brinzal, onion, bottle guard, and ridge gourd. Seed certification. Seed Act and its enforcement. Intellectual property rights, patenting, WTO, plant breeder rights. Principles and methods of seed drying. Seed processing. Planning and layout seed processing plant. Different upgrading equipments and their use. Seed testing procedures for quality assessment. Seed treatment and its importance. Seed packing and storage. Seed marketing and organizational setup.

Practical:

Seed sampling principles and procedures. Determination of physical purity, germination, moisture, vibility, seed health, seed vigour of crops. Seed dormancy and breaking methods. Visit to seed production plots testing laboratories and hybrid seed production farms.

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SEMESTER-II

STA-425: Experimental Designs for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

Theory:

Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data, completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions, orthogonality and partitioning of degrees of freedom confounding in 2^3 , 2^4 and 3^3 designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments; Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

Practical: **Time: 3 Hours**

Cross over and balanced incomplete block designs.

Note: Students shall be trained to use computer to analysis the data, using available software's. However, during university examination students are allowed to use scientific calculators to analysis is the data.

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SEMESTER-II

***VSC-423 Forcing Techniques in Vegetable Production**

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 20
Internal assessment 15+5=20
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Objectives, importance and scope of protected cultivation. Nursery raising techniques. Environmental factors. Vegetable growing media. Irrigation and fertigation. Sustainable land use systems. Maximizing and use efficiency i-protected structures. Problems of growing vegetables in protected structures,. Soil sterilization techniques. Hydroponics cultivation. . Pest management in green house/glass house. Crops and varieties suitable for protected cultivation. Specific technology for raising tomato, sweet pepper, cucumber and high value crops in off season. Cladding material for protected structures -use of mulches. Seed production of vegetables.

Practical: **Time: 3 Hours**

Study of various types of structures. Methods to control temperature, CO2, light. Demonstration for sanitation measures. Hydroponics. Maintenance of parental lines and hybrid seed production in glasshouse. Fertigation and nutrient management. Control of diseases and insect pests in glasshouse. Visit to established greenhouses in the region.

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SEMESTER-III

VSC-531 Fundamentals o Processing Of Vegetables
Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:
1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

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

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

UNIT III
Raw materials for processing. Primary and minimal processing; processing equipments; Layout and establishment of processing industry, FPO licence. Importance of hygiene; Plant sanitation.

UNIT IV
Quality assurance and quality control, TQM, GMP. Food standards – FPO, PFA, etc. Food laws and regulations.

UNIT V
Food safety – Hazard analysis and critical control points (HACCP). Labeling and labeling act, nutrition labeling.

UNIT VI
Major value added products from vegetables. Utilization of byproducts of vegetable processing industry; Management of waste from processing factory.

UNIT VII
Investment analysis. Principles and methods of sensory evaluation of fresh and processed vegetables.

Practical:

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

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SEMESTER-III

VSC-532 Protected Cultivation Of Vegetable Crops

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Crops: Tomato, capsicum, cucumber, melons and lettuce

UNIT I

Importance and scope of protected cultivation of vegetable crops; principles used in protected cultivation, energy management, low cost structures; training methods; engineering aspects.

UNIT II

Regulatory structures used in protected structures; types of greenhouse/polyhouse/nethouse, hot beds, cold frames, effect of environmental factors, *viz.* temperature, light, CO2 and humidity on growth of different vegetables, manipulation of CO2, light and temperature for vegetable production, fertigation.

UNIT III

Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

UNIT IV

Regulation of flowering and fruiting in vegetable crops, technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures, training and staking in protected crops, varieties and hybrids for growing vegetables in protected structures.

UNIT V

Problem of growing vegetables in protected structures and their remedies, insect and disease management in protected structures; soil-less culture, use of protected structures for seed production.

Practical:

Study of various types of structures, methods to control temperature, CO2 light, media, training and pruning, maintenance of parental lines and hybrid seed production of vegetables, fertigation and nutrient management, control of insect-pests and disease in greenhouse; economics of protected cultivation, visit to established green/polyhouse/net house/shade house in the region.

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SEMESTER-III

SSC-430 **Fertilizer Technology (Minor)**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Fertilizer industry in India; Raw materials; Manufacture of different types of fertilizers including reactions and flow diagrams; Granulation, segregation, caking, drying and cooling of fertilizers; Complex, mixed, liquid, suspension and slow release fertilizers; Production of fertilizers containing secondary and micronutrients; Changing trends in fertilizer technology.

Practical:

Collection of soil and fertilizer samples; Preparation of standard solutions. Colorimetric and flame photometric methods; Analysis of soil for fertilizer recommendations and suitability for orchard plantation; Gypsum and lime requirements of soil; Analysis of fertilizer for quality control; Planning and formulation of project on establishment of soil and fertilizer testing laboratories. Visit to fertilizer factories.

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-III

AGM-430 Fundamentals of Agroclimatology (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Survey of the atmosphere; introduction to basic meteorological processes; nature, receipt and disposal of solar radiation; Atmospheric humidity and forms condensation; Evaporation and evapotranspiration ; Winds, air masses and disturbance ;influence of climate on plants, animals and pests; Meterological droughts; indices in agroclimatrology ; Agroclimatic classifications and their application; field climate modification.

Practical:

Meteorological instruments and their use in the measurement of agroclimatic environment; Measurement of field climate; Computation of agroclimatic indices-GDD, PTU, PET etc; Determining crop production sensitivity to weather.

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-III

BOT-430 **Physiology of Growth and Development**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Concepts of growth, differentiation and pattern formation; growth curves, meristems, growth kinetics, factors affecting growth and general aspects of development, level of differentiation, control of development at genetic level. Hormones and growth regulators - auxins, gibberellins, cytokinins, ethylene, ABA, other inhibitors, retardants, polyamines, aliphatic alcohols, brassins, hormonal regulation of growth and development, plant movements; photoperiodism, phytochrome, flowering hormones, vernalization, abscission, ageing, senescence; physiology of seed and fruit development; seed germination; seed and bud dormancy. Plant physiology and agriculture.

Practical:

Experiments on growth measurements, hormonal bioassays, plant movements; experiments on quality of light on seed germination, breaking of dormancy. Experiments on photoperiodism. Experiments on hormonal regulation of development.

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-III

CREDIT SEMINAR

Total Marks: 100
Periods per week: 03

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-IV

VSC-541: Seed Certification, Processing and Storage of Vegetable Crops

Time: 3 Hours **Max. Marks: 100**

Theory: 60

Practical: 20

Internal assessment 15+5=20

Periods per week :4+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

UNIT I

Seed certification, objectives, organization of seed certification, minimum seed certification standards of vegetable crops, field inspection,specification for certification.

UNIT II

Seed processing, study of seed processing equipments seed cleaning and upgrading, Seed packing and handling, equipment used for packaging of seeds, procedures for allocating lot number.

UNIT III

Pre-conditioning, seed treatment, benefits, types and products, general principles of seed storage, advances in methods of storage, quality control in storage, storage containers, seed longevity and deterioration, sanitation, temperature and relative humidity control.

UNIT IV

Seed testing; ISTA rules for testing, moisture, purity germination, vigor test, seed sampling, determination of genuineness of varieties, seed viability, seed health testing; seed dormancy and types of dormancy, factors responsible for dormancy.

UNIT V

Seed marketing, demand forecast, marketing organization, economics of seed production; farmers' rights, seed law enforcement, seed act and seed policy.

Practical

Seed sampling, purity, moisture testing, seed viability, seed vigor tests, seed health testing, seed cleaning, grading and packaging; handling of seed testing equipment and processing machines; seed treatment methods, seed priming and pelleting; field and seed inspection, practices in rouging, seed storage, isolation distances, biochemical tests, visit to seed testing laboratories and processing plants, mixing and dividing instruments, visit to seed processing unit and warehouse visit and know about sanitation standards.

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-IV

VSC-542 Organic Vegetable Production Technology

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 20
Internal assessment 15+5=20
Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

UNIT I

Importance, principles, perspective, concept and component of organic production of vegetable crops.

UNIT II

Organic production of vegetables crops, *viz.,* solanaceous crops, cucurbits,cole crops, root and tuber crops.

UNIT III

Managing soil fertility, pests and diseases and weed problems in organic farming system; crop rotation in organic horticulture; processing and quality control for organic foods.

UNIT IV

Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous methods of compost, Panchagavvya, Biodynamics, preparation etc Pest and disease management in organic farming; ITK's in organic farming. Role of botanicals and bio-control agents.

UNIT V

GAP and GMP- Certification of organic products; organic production and export - opportunity and challenges.

Practical:

Method of preparation of compost, vermicomposting, biofertilizers, soil solarization, bio pesticides in horticulture, green manuring, mycorrhizae and organic crop production, waster management, organic soil amendment for root disease, weed management in organic horticulture. Visit to organic fields and marketing centers.

M.Sc. AGRICULTURE
(VEGETABLE SCIENCE)

SEMESTER-IV

RESEARCH WORK

Total Marks: 250
Periods per week: 04

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
ENT-511	Insect Morphology and Systematics	4	3	80	40	20	10	100	50	150
ENT-512	Insect Anatomy and Physiology	4	6	80	40	20	10	100	50	150
ENT-513	Classification of Insects	4	3	80	40	20	10	100	50	150
SSC-410/ PPL-410 (Minor)	Soil Chemistry and Bio Chemistry/ Principles of Plant Disease Management	4	6	80	40	20	10	100	50	150
STA-415	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

Course Code	Subject	Periods per week		Marks		Internal Assesment		Total Marks		Grand Total
		Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
ENT-521	Insect Ecology	4	3	80	40	20	10	100	50	150
ENT-522	Toxicology of Insecticides	4	6	80	40	20	10	100	50	150
ENT-523	Plant Resistance to Insects	4	3	80	40	20	10	100	50	150
BCH-420/ BCH-421 (Minor)	Insecticide Chemistry/ Pesticide Formulations	4	6	80	40	20	10	100	50	150
STA-425	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
Total		**20**	**21**	**400**	**200**	**100**	**50**	**500**	**250**	**750**

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-III

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal Assesment**		**Total Marks**		**Grand Total**
		Th.	**Prac**	**Th.**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	
ENT-531	Biological Control of Insect Pests	4	3	80	40	20	10	100	50	150
ENT-532	Integrated Pest Management	4	6	80	40	20	10	100	50	150
AGR-430/ BOT-430/ PPL-430 (Minor)	Weed management/ Physiology of Growth and Development/ Fungal Diseases of Plants	4	3	80	40	20	10	100	50	150
	Credit Seminar	-	3		100				100	100
	Research Work (Four periods per Teacher per Student)	-	4							
Total		**12**	**19**	**240**	**220**	**60**	**30**	**300**	**250**	**550**

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-IV

Course Code	**Subject**	**Periods per week**		**Marks**		**Internal assessment**		**Total Marks**		**Grand Total**
		Th.	**Pract.**	**Th.**	**Pract.**	**Th.**	**Prac**	**Th**	**Prac**	
ENT-541	Commercial Entomology	4	3	60	20	15	05	75	25	100
ENT-542	Storage Entomology	4	3	60	20	15	05	75	25	100
	Research Work (Four Periods per Teacher Per Student)		4		250				250	250
	Total	**08**	**10**	**120**	**290**	**30**	**10**	**150**	**300**	**450**

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

ENT-511 **Insect Morphology and Systematics**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Evolution of insect body form. Primary and secondary segmentation, structure of typical secondary segment. Different theories regarding segmentation of insect head. Comparative morphological characteristics of insects and their bearing in insect classification. Insect sense organs. Mechanism of flight. Insect Systematics - history and importance. Taxonomic categories. Taxonomic keys. Important rules of Zoological nomenclature. Ethics in taxonomy. Zoogeographical regions of world.

Practical:

Comparative study of morphological characteristics of representative type of insects. Collection and preservation of insects and their identification with the help of taxonomic keys. Preparation of taxonomic keys.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

ENT-512 **Insect Anatomy and Physiology**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Importance and scope of insect anatomy and physiology. Structure and physiology of insect integument. Comparative study of anatomy and physiology of digestive, circulatory, respiratory, excretory, reproductive, nervous, sensory, endocrine and exocrine systems. Embryonic and post-embryonic developments. Diapause. Insect nutrition, inter- and intracellular micro organisms. Artificial diets.

Practical:

Study of comparative anatomy of various organ systems of insects through dissection and preparation of mounts of internal organs. Experiments to highlight physiological significance of cuticle, digestive, circulatory, respiratory, excretory, endocrine and exocrine systems. Formulation and preparation of artificial diets for rearing of insects.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

ENT-513 **Classification of Insects**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

History of insect classification and its importance. Introduction to phylogeny of insects. Classification of Superclass Hexapoda including all the classes with special emphasis on Class Insecta.Distinguishing morphological characters alongwith the habits and habitats of insects belonging to economically important families of all the orders of Class Insecta.

Practical:

Collection and preservation of insects. Identification of insects upto family level. Field visits to collect insects of different orders.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

SSC-410: Soil Chemistry and Biochemistry (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory

Soil colloids–nature, properties, origin of charges and their significance; Cation and anion exchange phenomena and their importance; Introduction to ionic adsorption and fixation; Soil reaction and buffering; Distribution, characterization, genesis and amelioration of acid, acid sulphate, saline, saline-sodic, sodic and calcareous soils; Plant reaction and tolerance to soil salinity, sodicity and acidity; Chemical and electro chemical properties of submerged soils; Organic matter and characterization of clay –organic matter interaction ; Biochemical decomposition of organic manures and farm wastes, composting and vermicomposting, Biochemistry of humus formation and biogas production .

Practical:

Determination of the effect of dilution and salinity on soil pH; Active and potential acidity; Cation and anion exchange capacity and exchangeable cations; Soluble salts in soils; Lime and gypsum requirements. Nutrient adsorption and fixation capacities of soils; Estimation of biochemical constituents of organic residues- cellulose, hemi-cellulose, lignin and C: N ratio; Preparation of enriched compost, bio-fertilizers and vermiculture.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

PPL-410 Principles of Plant Disease Management

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals. Integrated control measures of plant diseases. Disease resistance and molecular pproach for disease management. Foliage, seed and soil application of chemicals. Role of stickers, spreaders and other adjuvants. History of fungicides, bactericides, antibiotics, antivirals. Concepts of pathogen, immobilization, chemical protection and chemotherapy. Nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals. Recent trends in the development of fungitoxicants, antibiotics and antiviral agents and relationships between their structures and activity. Environmental hazards, residual effects and safety measures.

Practical: In vitro and in vivo evaluation of chemicals against plant pathogens. Foliage, seed and soil application of chemicals. Role of stickers, spreaders and other adjuvants. ED and MIC values. Study of structural details of sprayers and dusters. Environmental hazards, residual effects and safety measures.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-I

STA-415: Statistical Methods for Research Workers

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.

Practical:

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Note: Students shall be trained to use computer to analysis the data, using available software's. However, during university examination students will use scientific calculators to analyse the data.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

ENT-521 **Insect Ecology**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Basic concepts of ecology. Organization levels. Ecosystem concept. Food chain. Characteristics of insect populations. Physical environment, its influence on abundance, distribution, rate of increase and diapauses in insects. Concept of intrinsic rate of increase.Biotic factors, intraspecific competition, logistic theory. Interspecific relationships, prey/predator models, effect of food and space on insects. Natural balance, population dynamics and regulation. Defense mechanisms against predators/parasitoids. Estimation of dispersal, migration and mortality factors. Life-tables and their application. Systems approach to ecology. Abundance and diversity of insects, its causes and estimates. Pest outbreaks and forecasting. Sampling considerations for population estimates of insects in different habitats. Pest management as applied ecology.

Practical:

Measurement of microenvironment- maintenance of physical factors, calculation of rate of increase (rm), stable age distribution and fitting of logistic curve for population growth. Determination of distribution pattern, and size and number of samples. Estimation of population of different groups of insect pests. Measurement of insect diversity. Life-tables for determining mortality factors.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

ENT-522 **Toxicology of Insecticides**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Definition, importance, scope, basic principle of insecticide toxicology and its relationship with other disciplines. Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, neonicotinoids, oxadiazines, phenylpyrozoles, botanicals and new promising compounds etc. Criteria, methods, problems and solutions of bioassay. Evaluation of insecticide toxicity, joint action of insecticides,
synergism, potentiation and antagonism, factors affecting toxicity of insecticides, selectivity and phytotoxicity. Insecticide metabolism, pest resistance to insecticides, mechanisms and types of resistance, insecticide resistance management and pest resurgence. 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.

Practical:

Insecticide formulation and mixtures, quality control of pesticide formulations. Working out doses and concentrations of pesticides for laboratory and field evaluation for their bioefficacy, bioassay techniques, probit analysis, evaluation of insecticide toxicity and joint action. Toxicity to beneficial insects. Preparation of working standard solutions of pesticides, Sampling, extraction, clean-up and estimation of insecticide residues by various methods, calculations and interpretation of data, visit to toxicology laboratories, good laboratory practices.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

ENT-523 **Plant Resistance to Insects**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

History and importance of host plant resistance. Principles, classification, components, types and mechanisms of resistance. Insect-host plant relationships. Theories and bases of host-plant selection. Chemical ecology. Tritrophic relations. Volatiles and secondary plant substances. Basis of resistance. Factors affecting plant resistance including biotypes and measures to combat them. Screening techniques.

Breeding for insect resistance in crop plants. Exploitation of wild plant species and gene transfer. Successful examples of resistant crop varieties in India and world. Role of biotechnology in plant resistance to insects.

Practical:

Screening techniques for measuring resistance. Measurement of plant characters and working out their correlations with plant resistance. Testing of resistance in important crops. Demonstration of antibiosis, tolerance and antixenosis.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

BCH-420 Insecticide Chemistry (Minor)

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week: 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Introduction and classification of synthetic insecticides, chemistry of conventional organochlorine insecticides: DDT, HCH, Lindane; uses, mode of action. Cyclodiene insecticides: nomenclature, uses, synthesis and mode of action of aldrin, dieldrin. Organophosphorus insecticides: chemistry, classification and mode of action. Important reactions namely Michaelis-Arbuzov reaction, Perkow reaction, Thiono-thiolo rearrangement. Preparation, properties and uses of eidfenphos, fenthion, DDVP, monocrotophos, phosphamidon, chlorfenvinfos, malathion, ethyl parathion, fenitrothion, quinalphos, diazinon, chlorpyrifos, disulfoton, dimethoate, acephate. Chemistry of carbamate insecticides: classification, synthesis, uses and mode of action of carbofuran, carbaryl, aldicarb, methomyl and propoxur. Synthetic pyrethroids: Chemistry, classification, mode of action, history and evolution from natural pyrethrins. Preparation, synthesis, uses and properties of cypermethrin, deltamethrin, fenvalerate, cyfluthrin, non-ester pyrethroid – ethofenprox. Neonicotinoids: Chemistry, classification, mode of action and uses. Preparation, properties and uses of imidacloprid, acetamiprid, thiocloprid.
General introduction and mode of action of ecdysones and ecdysoids. Inhibitors of chitin synthesis, chemosterilants.

Practical:

Preparation and characterization of DDT, DDE, and Methoxychlor, Preparation of organophosphorus insecticide: Part A – phosphorodichloridite and Part B – phosphonate, Preparation and characterization of oxime ether, Preparation of DDVP. Estimation of different insecticides

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

BCH-421 **Pesticide Formulations (Minor)**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week: 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

General aspects: definition, objectives, process, product spectrum, classification, formulation codes etc. Solid and liquid formulations including the latest developments: preparation, properties, specifications, use etc. Formulants: carriers/ diluents, surfactants, synergists, safeners, encapsulants, antioxidants, stabilizers etc. highlighting chemistry, classification, properties, use etc., formulant-toxicant interactions, pesticide mixtures. Machinery and equipment, packaging and labeling. Packaging standards, requirement, materials, disposal, decontamination etc. Labeling: content, specifications, needs for low literacy regions, etc. Application: principles, distribution and coverage, recent developments. Precautions in use of pesticides. Bio-efficacy: basic considerations and applied aspects, physico-chemical basis, pesticide antidotes.

Practical:

Equipment used in formulation research, Determination of acidity of a pesticide, Determination of alkalinity of a pesticide, Preparation of controlled release formulation, Release of active ingredient from CR formulation in soil and water, Preparation of toxicant based creams, Study of solid carriers: Determination of (i) Surface acidity by volumetric method, (ii) Surface area, study of solid carriers, (iii) Sorptivity and (iv) Particle size. Preparation of dust, wettable powder and granules, Determination of wettability and suspensibilty of wettable powder, Study of liquid carriers (i) Flash point and specific gravity, Study of liquid carriers (ii) Determination of viscosity. Study of surfactants: Micelle formation, Preparation of liquid formulations, Determination of emulsion stability of an emulsifiable concentrate, Application technology: Sprayers.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-II

STA-425: Experimental Designs for Research Workers
Time: 3 Hours

Max. Marks: 150
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Note: Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

Theory

Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data, completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions, orthogonality and partitioning of degrees of freedom confounding in 2^3 , 2^4 and 3^3 designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments; Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

Practical: **Time: 3 Hours**

cross over and balanced incomplete block designs.

Note: Students shall be trained to use computer to analysis the data, using available software's. However, during university examination students are allowed to use scientific calculators to analysis is the data.

M.Sc. AGRICULTURE
(ENTOMOLOGY)

SEMESTER-III

ENT-531 **Biological Control of Insect Pests**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per week : 04+3

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Principles and scope of biological control. Techniques in biological control. Biology and host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogens and their mode of action. Biological control of weeds using insects. Techniques for mass production of quality biocontrol agents. Various formulations and economics of bioagents. Field application and evaluation. Analysis of successful biological control projects. Trends and future possibilities of biological control. Importation of natural enemies and quarantine regulations. Biotechnology in biological control. Semiochemicals in biological control

Practical:

Identification of common natural enemies of crop pests and weed killers. Techniques for rearing of natural enemies. Visits (only where logistically feasible) to bio- control laboratories to learn rearing and mass production of natural enemies of crop pests and weeds and their laboratory hosts. Field collection of parasitoids and predators. Hands- on training in culturing and identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

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SEMESTER-III

ENT-532 **Integrated Pest Management**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+6

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

History and origin. Definition and evolution of various related terminologies. Concept and philosophy of IPM. Ecological principles. Determination of crop losses and economic thresholds. Integration of different pest management 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 and cost-benefit ratios. Case studies of successful IPM programmes. National and international set-ups for integrated pest management.

Practical:

Characterization of agro-ecosystems. Sampling methods and factors affecting sampling. Population estimation methods. Crop loss assessments, potential losses, avoidable losses, unavoidable losses. Computation of EIL and ETL. Crop modelling, designing and implementing IPM system.

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SEMESTER-III

AGR-430 **Weed Management**

Time: 3 Hours **Max. Marks: 150**
Theory: 80
Practical: 40
Internal assessment 20+10=30
Periods per Week 4+6

Instructions for the paper setters

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Weeds- Introduction, harmful and beneficial effects, characteristics and classification. Weed biology and ecology. Crop weed association, competition and allelopathy. Concepts of weed prevention, control and eradication. Methods of weed control. Physical, cultural, chemical, biological and integrated weed management. Herbicides- classification, formulation, advantages ,disadvantages and methods of application. Introduction to adjuvant and their use in herbicides. Introduction to selectivity of herbicides. Mode of action and fate of herbicides in soil. Compatibility of herbicides with other agrochemicals. Weed management in major field and horticultural crops and in non cropped areas. Shift in weed flora in cropping systems. Classification, useful and harmful aspects and control measures of aquatic weeds. Problematic weeds and their control.

Practical:

Identification of weeds and weed seeds. Survey of weeds in crop fields and other habitats. Preparation of weed herbarium. Computation of herbicide doses, weed control efficiency and weed index. Methods of recording weed intensity under different situations. Herbicide label information of commonly available herbicides. Herbicide application equipments and their calibration. Diagnosis of herbicide toxicity symptoms in different crops and weeds. Visits to problem areas.

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SEMESTER-III

BOT-430 Physiology of Growth and Development

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Concepts of growth, differentiation and pattern formation; growth curves, meristems, growth kinetics, factors affecting growth and general aspects of development, level of differentiation, control of development at genetic level. Hormones and growth regulators - auxins, gibberellins, cytokinins, ethylene, ABA, other inhibitors, retardants, polyamines, aliphatic alcohols, brassins, hormonal regulation of growth and development, plant movements; photoperiodism, phytochrome, flowering hormones, vernalization, abscission, ageing, senescence; physiology of seed and fruit development; seed germination; seed and bud dormancy. Plant physiology and agriculture.

Practical:

Experiments on growth measurements, hormonal bioassays, plant movements; experiments on quality of light on seed germination, breaking of dormancy. Experiments on photoperiodism. Experiments on hormonal regulation of development.

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SEMESTER-III

PPL-430 **Fungal Diseases of Plants**

Time: 3 Hours **Max. Marks: 150**

Theory: 80

Practical: 40

Internal assessment 20+10=30

Periods per week : 04+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Nomenclature, classification and general characterization of fungi. Description of important phytopathogenic genera. Study of representative fungal diseases with emphasis on their distribution, symptomatology, etiology, epidemiology and control. Post harvest diseases in transit and storage and their management.

Practical: Characteristics of important phytopathogenic genera and of fungi and their identification.Macro and microscopic diagnosis of representative diseases of various crops.

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SEMESTER-III

CREDIT SEMINAR

Total Marks: 100
Periods per week: 03

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SEMESTER-IV

ENT-541 **Commercial Entomology**

Time: 3 Hours **Max. Marks: 100**

Theory: 60

Practical: 20

Internal assessment 15+5=20

Periods per week :4+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Development of apiculture. Classification of bees and distribution of genus Apis. Morphological adaptations. Behaviour and activities of honey bees. Honey bee nutrition. Artificial queen bee rearing and bee breeding. Sex and caste determination. Honey bee ecology. Bee pheromones. Pests and diseases of honey bees. Bee poisoning. Hive products. Planned crop pollination using bees. Silkworm species and their characteristics. Moriculture. Silk seed production. Rearing and management of silkworms. Pests and diseases of silkworms. Silk and its uses. Lac insect's management. Economic importance of insect-pests of human health and habitation. Biology, damage and management strategies for mosquitoes, house flies, bed bugs, ants, termites, cockroaches and wasps.

Practical:

Morphological adaptations in different castes of honey bees. Recording of colony data. Selection and breeding of honey bees. Latest techniques in mass queen bee rearing. Artificial diets and feeding. Production and extraction of hive products. Preparation of beekeeping projects. Recording pollination behaviour and determining pollination requirements. Identification of different species of silkworms. Silkworm rearing equipment. Silkworm rearing and management. Diseases of silkworms. Lac insect and host management. Lac collection and processing. Management of insect-pests of public health importance and human dwellings.

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SEMESTER-IV

ENT-542 **Storage Entomology**

Time: 3 Hours **Max. Marks: 100**

Theory: 60

Practical: 20

Internal assessment 15+5=20

Periods per week :4+3

Instructions for the paper setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. Not more than one question should be based on one topic.
4. The question paper should cover the whole syllabus and questions should be evenly distributed.
5. At least eight questions should be set, out of which the candidates should be required to attempt any five.

Theory:

Introduction, history and concepts of storage entomology. Post-harvest losses. Factors responsible for grain losses. Important pests namely insects, mites, rodents, birds and micro-organisms associated with stored grains and agricultural products. Association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage. Sources of infestation. Type of losses in stored grains and their effect on quality including biochemical changes. Ecology of insect pests of stored commodities. Stored grain deterioration process. Type of storage structures. Ideal storage conditions. Management of rodent and bird pests. Preventive and curative measures for the management of insect pests of stored grains. Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.

Practical:

Collection and identification of stored grains insect pests and their nature of damage. Detection of insect infestation in stored food grains and estimation of stored losses. Determination of micro flora of grains. Determination of grain moisture. Familiarization of storage structures. Laboratory culturing of stored grain pests. Demonstration of preventive and curative measures including fumigation techniques. Field visits to grain markets, central and FCI warehouses, IGSMRI and commercial silos.

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SEMESTER-IV

RESEARCH WORK

Total Marks: 250
Periods per week: 04