

FACULTY OF AGRICULTURE & FORESTRY

SYLLABUS

FOR

M. Sc. AGRICULTURE (Honours) (Semester: I-IV)

Examinations: 2012-13



Guru Nanak Dev University Amritsar

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M. Sc. AGRIC. (HONS) Course SEMESTER SYSTEM
Scheme of Studies & Examination
Semester-I (Horticulture Group)

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Aгри.501 Hort.	Tropical Fruit Production and Dry Land Horticulture	3	3	80	40	20	10	100	50	150
2	M.Sc.Aгри. 503 Hort	Nutrient and Canopy Management in Fruit Crops	3	6	80	40	20	10	100	50	150
3	M.Sc.Aгри.504 Hort.	Systematic Pomology	3	3	80	40	20	10	100	50	150
4	M.Sc. Agri. 451 Minor Soil/Veg. 422	Soil Chemistry and Bio Chemistry/ Vegetable Breeding and Seed Production	4	6	80	40	20	10	100	50	150
5	M.Sc Agri. 421 Stat	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
	Total:		17	21	400	200	100	50	500	250	750

Semester-II (Horticulture Group)

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Aгри.502 Hort.	Sub Tropical and Temperate Fruit Production	3	3	80	40	20	10	100	50	150
2.	M.Sc. Agri. 505 Hort.	Breeding of Fruit Crops	3	3	80	40	20	10	100	50	150
3	M.Sc.Aгри. 506 Hort.	Post Harvest Technology of Fruit Crops	3	6	80	40	20	10	100	50	150
4	M.Sc. Agric. 452 Minor Soil/Veg 530	Soil Fertility and Fertilizer Use/Protected Cultivation of Vegetables	4	6	80	40	20	10	100	50	150
5	M.Sc. Agric. 422 Stat.	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
		Total:	17	21	400	200	100	50	500	250	750

**Scheme of Studies & Examination
Semester-III (Horticulture Group)**

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Aгри.507 Hort.	Plant Growth Regulators in Fruit Crops	3	3	80	40	20	10	100	50	150
2	M.Sc.Aгри. 508 Hort	Orchard Floor Management	3	6	80	40	20	10	100	50	150
3	M.Sc.Aгри Minor supporting 453 Soil/ 526 Veg./421 Agromet	Fertilizer Technology/ Vegetable Seed Technology/ Fundamentals of Agroclimatology	4	-	80	-	20	-	100	-	100
4	M.Sc. Agri. Hort.	Research work (Four periods per Teacher per student)		4	Lay out of the Research Trial						
	Total		10	13	240	80	60	20	300	100	400

*M.Sc. (Agriculture) (Honours) (Semester I-IV)***Scheme of Studies & Examination
Semester-IV (Horticulture Group)**

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Agri.509 Hort.	Citriculture	3	3	60	20	15	05	75	25	100
2.	M.Sc. Agri. 510 Hort	Clinical Orchard Problems	3	3	60	20	15	05	75	25	100
3	M.Sc.Agric Minor supporting 454 Soil/ 526 Veg./421 Agromet/	Soil Water & Fertilizer Testing/ Vegetable Seed Technology/ Fundamentals of Agroclimatology/	-	3	Nil	40	Nil	10	Nil	50	50
4	M.Sc. Agric. Hort.	Research Work (Four Periods Per Teacher Per student)		4		250				250	250
		Total	06	13	120	330	30	20	150	350	500

Hort. 501 Tropical Fruit Production and Dry Land Horticulture**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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- citrus, 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.

Hort. 501 Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 03

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.

Suggested Readings

Bose TK, Mitra SK & Rathore DS. (Eds.). 1988. *Temperate Fruits - Horticulture*. Allied Publ.

Bose TK, Mitra SK & Sanyal D. 2001. (Eds.). *Fruits -Tropical and Subtropical*. Naya Udyog.

Chadha KL & Pareek OP. 1996. (Eds.). *Advances in Horticulture*. Vols. IIIIV. Malhotra Publ. House.

Nakasone HY & Paul RE. 1998. *Tropical Fruits*. CABI.

Peter KV. 2008. (Ed.). *Basics of Horticulture*. New India Publ. Agency.

Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. Parts I, II. New India Publ. Agency.

Radha T & Mathew L. 2007. *Fruit Crops*. New India Publ. Agency.

Singh HP, Negi JP & Samuel JC. (Eds.). 2002. *Approaches for Sustainable Development of Horticulture*. National Horticultural Board.

Singh HP, Singh G, Samuel JC & Pathak RK. (Eds.). 2003. *Precision Farming in Horticulture*. NCPAH, DAC/PFDC, CISH, Lucknow.

Hort. 503 Nutrient and Canopy Management in Fruit Crops**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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.

Hort. 503 Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 06

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.

Suggested Readings

Chadha KL & Shikhamany SD. 1999. *The Grape, Improvement, Production and Post Harvest Management*. Malhotra Publ. House.

Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. New India Publ.

Hort. 504 Systematic Pomology**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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).

Hort. 504 Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 03

Vegetative and floral morphology of fruit plants. Description and identification of pome, stone, citrus and other major fruits (mango, 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. Agric. Minor Soil 451: (Opt. i) Soil Chemistry and Biochemistry**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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 .

Minor Soil 451 (Practical)**Time: 3 Hours****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 06**

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. Agric. Veg.422 (Opt. ii) : Vegetable Breeding and Seed Production**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

Scope of vegetable breeding and seed production; Origin, floral biology and breeding system 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 by using male sterility, self-incompatibility, various sex-forms etc; Methods of productions of nucleus; breeder; foundation and certified seeds, isolation, pollination , seed harvesting, processing and storage; Seed testing and certification ; Vegetable seed industries and its problems; Seed act.

Practical Vegetable: 422

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 06

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.

Stat 421-- Statistical Methods for Research Workers**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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.

Stat-421 : Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 03

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.

Suggested Readings

Black TR. 1993. *Evaluating Social Science Research - An Introduction*. SAGE Publ.

Creswell JW. 1999. *Research Design - Qualitative and Quantitative Approaches*. SAGE Publ.

Dhondyal SP. 1997. *Research Methodology in Social Sciences and Essentials of Thesis Writing*. Amman Publ. House, New Delhi.

Kothari CR. 2004. *Research Methodology - Methods and Techniques*. Wishwa Prakashan, Chennai.

Rao KV. 1993. *Research Methodology in Commerce and Management*. Sterling Publ., New Delhi.

Singh AK. 1993. *Tests, Measurements and Research Methods in Behavioural Sciences*. Tata McGraw-Hill.

Venkatasubramanian V. 1999. *Introduction to Research Methodology in Agricultural and Biological Sciences*. SAGE Publ.

Hort. 502 Sub-tropical and Temperate Fruit Production**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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.

Hort. 502 Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 03

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.

Suggested Readings

Bose TK, Mitra SK & Sanyal D. (Ed.). 2002. *Fruits of India – Tropical and Sub-tropical*. 3rd Ed. Vols. I, II. Naya Udyog.

Chadha KL & Pareek OP. 1996. (Eds.). *Advances in Horticulture*. Vol. I. Malhotra Publ. House.

Chadha KL & Shikhamany SD. 1999. *The Grape: Improvement, Production and Post-Harvest Management*. Malhotra Publ. House.

Janick J & Moore JN. 1996. *Fruit Breeding*. Vols.I-III. John Wiley & Sons.

Nijjar GS. 1977. (Eds.). *Fruit Breeding in India*. Oxford & IBH.

Radha T & Mathew L. 2007. *Fruit Crops*. New India Publ. Agency.

Singh S, Shivankar VJ, Srivastava AK & Singh IP. (Eds.). 2004. *Advances in Citriculture*. Jagminder Book Agency.

Hort. 505 Breeding of Fruit Crops**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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.

Hort. 505 Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 03

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.

Suggested Readings

Bose TK, Mitra SK & Sanyal D. (Eds.). 2002. *Fruits of India – Tropical and Sub-tropical*. 3rd Ed. Vols. I, II. Naya Udyog.

Chadha KL & Pareek OP. 1996. (Eds.). *Advances in Horticulture*. Vol. I. Malhotra Publ. House.

Chadha KL & Shikhamany SD. 1999. *The Grape: Improvement, Production and Post-Harvest Management*. Malhotra Publ. House.

Janick J & Moore JN. 1996. *Fruit Breeding*. Vols.I-III. John Wiley & Sons.

Nijjar GS. 1977. (Eds.). *Fruit Breeding in India*. Oxford & IBH.

Radha T & Mathew L. 2007. *Fruit Crops*. New India Publ. Agency.

Singh S, Shivankar VJ, Srivastava AK & Singh IP. (Eds.). 2004. *Advances in Citriculture*.

Jagminder Book Agency.

Hort. 506 Post-harvest Technology of Fruit Crops**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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.

Hort. 506 Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 06

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.

Suggested Readings

Bhutani RC. 2003. *Fruit and Vegetable Preservation*. Biotech Books.

Chadha KL & Pareek OP. (Eds.). 1996 *Advances in Horticulture*. Vol. IV. Malhotra Publ. House.

Haid NF & Salunkhe SK. 1997. *Post Harvest Physiology and Handling of Fruits and Vegetables*. Grenada Publ.

Mitra SK. 1997. *Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits*. CABI.

Ranganna S. 1997. *Hand Book of Analysis and Quality Control for Fruit and Vegetable Products*. Tata McGraw-Hill.

Sudheer KP & Indira V. 2007. *Post Harvest Technology of Horticultural Crops*. New India Publ. Agency.

Willis R, Mc Glassen WB, Graham D & Joyce D. 1998. *Post Harvest. An Introduction to the Physiology and Handling of Fruits, Vegetables and Ornamentals*. CABI.

M. Sc. Agric. 452 (Opt. i) : Minor Soil: Soil Fertility and Fertilizer Use**Time: 3 Hours****Max. Marks: 100****Theory = 80****Int. Assess: 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.**

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.

Minor Soil 452 : Practical

Time: 3 Hours

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 06

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. Agric. Veg.530 (Opt. ii): Protected cultivation of Vegetables**Time: 3 Hours****Max. Marks: 100****Theory = 80****Int. Assess: 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.**

Objectives, Importance and scopes of protected cultivation of vegetable crops; Principles used in protected cultivation; Regulatory structures/ glass houses; Effect of different factors such as temperature, light, CO₂ and humidity on growth of different vegetables; fertigation, nursery raising under protected structures like poly tunnels; Regulation of flowering and fruiting in vegetable crops; 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 CO₂, 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.

Vegetable-530 : Practical**Time: 3 Hours****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 06**

Study of various types of structures, methods to control temperature, CO₂, 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. Agric. Stats 422: Experimental Designs for Research Workers**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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

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.

Stats-422 : Practical**Time: 3 Hours****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

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. Agric. 507 Hort.: Plant Growth Regulators in Fruit Crops**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 20****Periods per week (Th.): 03****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.

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.

Hort. 507 : Practical**Time: 3 Hours****Max. Marks: 50****Practical: 40****Int. Assess.: 10****Periods per week (Pract.): 03**

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 bioassays for the estimation of plant regulators.

M. Sc. Agric. Hort 508: Orchard Floor Management and Organic Agriculture**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess: 20****Periods per week (Th): 03****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.

Soil quality and its management for orchard plantation. Effect of soil organic matter on physico-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.

508 Hort. : Practical**Time: 3 Hours****Max. Marks: 50****Practical: 40****Int. Assess.: 10****Periods per week (Pract): 03**

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. Agric. Opt. (i) 453 Minor Soil: Fertilizer Technology**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.

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.

M. Sc. Agric. Opt. (ii) 526 Veg: Vegetable Seed Technology**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.

History and development of vegetable seed industry in India and abroad; Role of environmental factors in seed production in different crops; procedure of producing of breeder, foundation, registered and certified seed; techniques of hybrid seed production; seed testing and certification-principles, producers, and international co-operation; seed proceeding, packaging, storage and marketing; seed acts; economics of seed production; intellectual property right and world trade organization

M. Sc. Agric. Opt. (iii) 421 Agromet: Fundamentals of Agroclimatology**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.**

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; Meteorological droughts; indices in agroclimatology ; Agroclimatic classifications and their application; field climate modification.

M. Sc. Agric. 509 Hort.: Citriculture**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.

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.

Hort. 509 : Practical**Time: 3 Hours****Max. Marks: 25****Practical: 20****Int. Assess.: 05****Periods per week (Pract.): 03**

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. Agric. 510 Hort.: Clinical Orchard Problems**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.

Clinical orchard problems regarding insect, pests, diseases and disorder and their suitable control measures of citrus, mango, pear, peach, plum, grape, ber, papaya, guava, banana and apple

Hort. 510: Practical**Time: 3 Hours****Max. Marks: 25****Practical: 20****Int. Assess.: 05****Periods per week (Pract.): 03**

Clinical diagnosis of orchard problems and their solution: collection of diseased, insect pest attacked and disordered specimens.

Opt.(i): Minor Soil. 454: Soil, Water and Fertilizer Testing (Practical)**Time: 3 Hours****Max. Marks: 50****Practical: 40****Int. Assess.: 10****Periods per week (Pract.): 03**

Collection of soil, irrigation water and fertilizer samples; Sampling of industrial effluents and municipal wastewaters; 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 irrigation waters to evaluate their suitability for irrigation purposes; Analysis of fertilizer for quality control; Planning and formulation of project on establishment of soil, water, plant and fertilizer testing laboratories. Visit to fertilizer factories.

Opt.(ii)Veg: 526: Vegetable Seed Technology (Practical)**Time: 3 Hours****Max. Marks: 50****Practical: 40****Int. Assess.: 10****Periods per week (Pract.): 03**

Floral biology of tomato, capsicum, beans, cauliflower, cabbage, cucumber, peas, spinach, onion and carrot; methods of seed production in cole crops, bulb crops, solanaceous vegetables, cucurbits, leafy vegetables, salad vegetables; Rouging of off –types; methods of hybrid seed production in important vegetable crops; field trips to seed production areas; testing of vegetable seed for germination, genetic and physical purity; use of chemicals for improving germination; study of varieties; Vigour test; isolation distances for different crops; seed extraction techniques of important vegetables; Breaking seed and plant material dormancy

Opt.(iii) Agromet: 421: Fundamentals of Agroclimatology (Practical)**Time: 3 Hours****Max. Marks: 75****Practical: 60****Int. Assess.: 15****Periods per week (Pract.): 03**

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. Agric. Opt.(iv) 502 Stats: Design of Surveys**Time: 3 Hours****Max. Marks: 75****Practical: 60****Int. Assess.: 15****Periods per week (Th.): 03**

Frequency tables, measures of central tendency and dispersion, regression, correlation, tests of hypothesis, analysis of completely randomized design and randomized block design.

M. Sc. Agric. Hort. RESEARCH WORK Total Marks =250

M.Sc. AGRIC. (HONS)-Semester System
Scheme of Studies & Examination 2012-13
SEMESTER I AGRONOMY GROUP

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Aгри.501 Agron	Modern Concepts in Crop Production	3	3	80	40	20	10	100	50	150
2	M.Sc.Aгри. 502 Agron	Soil Fertility & Nutrient Management	3	6	80	40	20	10	100	50	150
3	M.Sc.Aгри.504 Agron	Principles and Practices of Water Management	3	3	80	40	20	10	100	50	150
4	M.Sc. Agri. 451 Minor Soil	Soil Chemistry and Bio Chemistry	4	6	80	40	20	10	100	50	150
5	M.Sc Agri. 421 Stat	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
	Total		17	21	400	200	100	50	500	250	750

M.Sc. AGRIC. (HONS)-Semester System
Scheme of Studies & Examination 2012-13
SEMESTER II AGRONOMY GROUP

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Agri.503 Agron	Principles and Practices of Weed Management	3	6	80	40	20	10	100	50	150
2.	M.Sc. Agri. 507 Agron	Agronomy of Oil Seeds, Fibre and Sugar Crops	3	3	80	40	20	10	100	50	150
3	M.Sc.Agri. 514 Agron	Field Plot Techniques	3	3	80	40	20	10	100	50	150
4	M.Sc. Agric. 452 Minor Soil	Soil Fertility and Fertilizer Use	4	6	80	40	20	10	100	50	150
5	M.Sc. Agric. 422 Stat.	Experimental Designs for Research Worker	4	3	80	40	20	10	100	50	150
		Total	17	21	400	200	100	50	500	250	750

M.Sc. AGRIC. (HONS)-Semester System
Scheme of Studies & Examination 2012-13
SEMESTER III AGRONOMY GROUP

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Agri.506 Agron	Agronomy of Major Cereals and Pulses	3	3	80	40	20	10	100	50	150
2	M.Sc.Agri.513 Agron	Principles and Practices of Organic Farming	3	6	80	20	20	10	100	50	150
3	M.Sc.Agric Minor supporting 453 Soil/ 526 Veg./421 Agromet/	Fertilizer Technology/ Vegetable Seed Technology/ Fundamentals of Agroclimatology	3	-	80	Nil	20	Nil	100	Nil	100
4	M.Sc. Agronomy	Research work (Four periods per Teacher per student)		4	Lay out of the Research Trial						
	Total		9	13	240	80	60	20	300	100	400

M.Sc. AGRIC. (HONS)-Semester System
Scheme of Studies & Examination 2012-13
SEMESTER IV AGRONOMY GROUP

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc.Agric. 511 Agron	Cropping Systems and Sustainable Agriculture	3	3	60	20	15	05	75	25	100
2.	M.Sc. Agri. 512 Agron	Dry Land Agriculture and Water shed Management	3	3	60	20	15	05	75	25	100
3	M.Sc.Agric Minor supporting 454 Soil/ 526 Veg./421 Agromet/	Soil Water & Fertilizer Testing/ Vegetable Seed Technology/ Fundamentals of Agroclimatology/	-	3	Nil	40	Nil	10	Nil	50	50
4	M.Sc. Agric. Hort.	Research Work (Four Periods Per Teacher Per student)		4		250				250	250
		Total	06	13	120	330	30	20	150	350	500

Agron. 501 Modern Concepts in Crop Production**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 03**

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.

Suggested Readings

Balasubramaniyan P & Palaniappan SP. 2001. *Principles and Practices of Agronomy*. Agrobios.

Fageria NK. 1992. *Maximizing Crop Yields*. Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. 7th Ed. Prentice Hall.

Paroda R.S. 2003. *Sustaining our Food Security*. Konark Publ.

Reddy SR. 2000. *Principles of Crop Production*. Kalyani Publ.

Sankaran S & Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ.

Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.

Agron. 502 Soil Fertility and Nutrient Management**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 06**

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.

Suggested Readings

Brady NC & Weil R.R 2002. *The Nature and Properties of Soils*. **13th** Ed. Pearson Edu.

Fageria NK, Baligar VC & Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops*.

Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers*. **7th** Ed.

Prentice Hall.

Prasad R & Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.

Yawalkar KS, Agrawal JP & Bokde S. 2000. *Manures and Fertilizers*., Agri-Horti Publ.

Agron. 504 Principles and Practices of Water Management**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 20****Periods per week (Th): 03****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.

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****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 03**

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. Agric. Minor Soil 451: Soil Chemistry and Biochemistry**Time: 3 Hours****Max. Marks: 100****Theory = 80****Int. Assess: 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.**

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 .

Minor Soil 451 (Practical)**Time: 3 Hours****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week (Pract): 06**

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. Agric. Stats 421: Statistical Methods for Research Workers**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.

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

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 cell frequencies, transformation of data.

Stats 421 (Practical)**Time: 3 Hours****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

Agron 503 Principles and Practices of Weed Management**Time: 3 Hours****Max. Marks: 100****Theory = 80****Int. Assess: 20****Periods per week (Th): 03****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****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 06**

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.

Suggested Readings

Aldrich RJ & Kramer RJ. 1997. Principles in Weed Management. Panima Publ.

Ashton FM & Crafts AS. 1981. Mode of Action of Herbicides. 2nd Ed. Wiley Inter-Science.

Gupta OP. 2007. Weed Management- Principles and Practices. Agrobios.

Rao VS 2000. Principles of Weed Science. Oxford & IBH.

Subramanian S, Ali AM & Kumar RJ 1997. All About Weed Control. Kalyani.

US Walia, 2007. Principles of Weed Control. Kalyani

Agron. 507 Agronomy of Oilseeds, Fibre and Sugar Crops**Time: 3 Hours****Max. Marks: 100****Theory = 80****Int. Assess: 20****Periods per week (Th): 03****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****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 03**

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 phenological studies at different growth stages of crop; intercultural operations in different crops; cotton seed treatment; working out growth indices (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.

Suggested Readings

Das NR. 2007. Introduction to Crops of India. Scientific Publ.

Das PC. 1997. Oilseed Crops of India. Kalyani.

Lakshmikantam N. 1983. Technology in Sugarcane Growing. 2nd Ed. Oxford & IHM.

Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.

Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.

Singh SS. 1998. Crop Management. Kalyani.

Agron. 514 Field Plot Techniques**Time: 3 Hours****Max. Marks: 100****Theory = 80****Int. Assess: 20****Periods per week (Th): 03****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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

Actual layout of field experiments. Critical examination of experiments scientific journals. Compilation and interpretation of the given data. Missing plots and analysis of variance results. Use of computers for analysis

M. Sc. Agric. 452 Minor Soil: Soil Fertility and Fertilizer Use**Time: 3 Hours****Max. Marks = 100****Theory = 80****Int. Assess = 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.**

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 Minor Soil 452**Time: 3 Hours****Max. Marks = 50****Practical =40****Int. Assess. = 10****Periods per week = 06**

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. Agric. Stats 422: Experimental Designs for Research Workers**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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

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 Stats 422**Time: 3 Hours****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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 ,

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.

Agron. 506 Agronomy of Major Cereals and Pulses**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 20****Periods per week (Th.): 03****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 *Kharif and Rabi* pulses.

Practical

Phenological 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

Agron. 513 Agron. Principles and Practices of Organic Farming**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 20****Periods per week (Th.): 03****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 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.

Aerobic and anaerobic methods of making compost; making of vermicompost; identification and nursery raising of important agro-forestry trees and trees for shelter belts; efficient use of biofertilizers, technique of treating legume seeds with *Rhizobium*, *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. Agric. Opt. (i) 453 Minor Soil: Fertilizer Technology**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.

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.

M. Sc. Agric. Opt. (ii) 526 Veg: Vegetable Seed Technology**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.

History and development of vegetable seed industry in India and abroad; Role of environmental factors in seed production in different crops; Procedure of producing of breeder, foundation, registered and certified seed; Techniques of hybrid seed production; Seed testing and certification-principles, producers, and international co-operation; Seed proceeding, packaging, storage and marketing; Seed acts; Economics of seed production; Intellectual property right and world trade organization.

M. Sc. Agric. Opt. (iii) 421 Agromet: Fundamentals of Agroclimatology**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.

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; Meteorological droughts; indices in agroclimatology; Agroclimatic classifications and their application; Field climate modification

M. Sc. Agric. Opt. (iv) 502 Stats: Design of Surveys**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.

Importance of sample surveys, designing of a survey, preparation of questionnaire, sampling from a finite population, simple random sampling, probability, proportional to size sampling ration and regression methods of estimation, systematic, stratified, cluster and multistage sampling.

Agron. 511 Cropping Systems and Sustainable Agriculture**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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**Practical:**

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

Agron. 512 Dryland Farming and Watershed Management**Time: 3 Hours****Max. Marks: 75****Theory: 60****Int. Assess.: 15****Periods per week (Th.): 03****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.**

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.**

Practical: Opt. (i): Minor Soil. 454: Soil, Water and Fertilizer Testing**Time: 3 Hours****Max. Marks: 75****Practical: 60****Int. Assess.: 15****Periods per week (Pract.): 03**

Collection of soil, irrigation water and fertilizer samples; Sampling of industrial effluents and municipal wastewaters; 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 irrigation waters to evaluate their suitability for irrigation purposes; Analysis of fertilizer for quality control; Planning and formulation of project on establishment of soil, water, plant and fertilizer testing laboratories. Visit to fertilizer factories.

Practical: Opt. (ii) Veg: 526: Vegetable Seed Technology**Time: 3 Hours****Max. Marks: 75****Practical: 60****Int. Assess.: 15****Periods per week (Pract.): 03**

Floral biology of tomato, capsicum, beans, cauliflower, cabbage, cucumber, peas, spinach, onion and carrot; methods of seed production in cole crops, bulb crops, solanaceous vegetables, cucurbits, leafy vegetables, salad vegetables; Rouging of Off –types ; methods of hybrid seed production in important vegetable crops; field trips to seed production areas ; testing of vegetable seed for germination , genetic and physical purity; use of chemicals for improving germination; study of varieties; Vigour test; isolation distances for different crops; seed extraction techniques of important vegetables; Breaking seed and plant material dormancy.

Practical : Opt. (iii) Agromet: 421: Fundamentals of Agroclimatology**Time: 3 Hours****Max. Marks: 75****Practical: 60****Int. Assess.: 15****Periods per week (Pract.): 03**

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. Agric. Opt.(iv) 502 Stat: Design of Surveys**Time: 3 Hours****Max. Marks: 75****Practical: 60****Int. Assess.: 15****Periods per week (Th.): 03**

Frequency tables, measures of central tendency and dispersion, regression, correlation, tests of hypothesis, analysis of completely randomized design and randomized block design.

M. Sc. Agric. Agronomy: RESEARCH WORK Total Marks: 250

Semester-I (Agric. Economics Group)

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc. Agric 505 Ag. Econ.	Agri. Marketing & Price Analysis	4	3	80	40	20	10	100	50	150
2	M.Sc. Agric 507 Ag. Econ.	Econometrics	4	3	80	40	20	10	100	50	150
3	M.Sc. Agric 516 Ag. Econ..	Farm Management Economics	4	6	80	40	20	10	100	50	150
4	M.Sc. Agric 421 Stat	Statistical Methods for Research Workers	4	3	80	40	20	10	100	50	150
5.	Minor Agron. 422	Crop Ecology	4	6	80	40	20	10	100	50	150
Total			20	21	400	200	100	50	500	250	750

Semester-II (Agric. Economics Group)

Sr. No.	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M. Sc. Agric 504 Ag.Econ.	Agricultural Production Economics	4	6	80	40	20	10	100	50	150
2	M. Sc. Agric 506 Ag.Econ.	Research Methodology for Social Sciences	4	3	80	40	20	10	100	50	150
3	M. Sc. Agric 509Ag.Econ..	Agri. Finance & Project Management	4	3	80	40	20	10	100	50	150
4	M. Sc. Agric Minor Agron 451./Veg 421	Cropping System	4	3	80	40	20	10	100	50	150
5	M. Sc. Agrc Eco. 508	Linear Programming	4	6	80	40	20	10	100	50	150
		Total	20	21	400	200	100	50	500	250	750

*M.Sc. (Agriculture) (Honours) (Semester I-IV)***Semester-III (Agric. Economics Group)**

Sr. No .	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc. Agric 501 Ag.Econ.	Micro Economics	6	Nil	80	Nil	20	Nil	100	Nil	100
2	M.Sc. Agric 503 Ag.Econ.	Evolution of Thought	4	Nil	80	Nil	20	Nil	100	Nil	100
3	M.Sc. Agric 514 Ag.Econ..	Rural Marketing	4	Nil	80	Nil	20	Nil	100	Nil	100
4	M.Sc.Agric Minor supporting .521 Mgt./ 524 Stat.	Agri -Business Management/ Sampling Theory	4	Nil	80	Nil	20	Nil	75	Nil	100
	M.Sc. Agric Ag.Econ	Research Work (four periods per Teacher per student)		4	Lay out of the research field						
Total			18	NIL	320	NIL	80	NIL	375	NIL	400

Semester-IV (Agric. Economics Group)

Sr. No .	Course Code	Subject	Periods per week		Marks		Int. Assessment		Total Marks		Grand Total
			Th.	Pract.	Th.	Pract.	Th.	Pract.	Th.	Pract.	
1	M.Sc. Agric 502 Ag.Econ.	Macro Economics and Policy	6	Nil	80	Nil	20	Nil	100	Nil	100
2	M.Sc. Agric 511 Ag.Econ.	Agricultural Development, And Policy	6	Nil	80	Nil	20	Nil	100	Nil	100
3	M.Sc.Agric Minor supporting. 521 Mgt./524 Stat.	Agri -Business Management/ Sampling Theory	0	3	Nil	40	Nil	10	Nil	75	50
4	M.Sc. Agric Ag.Econ	Research work (four periods per Teacher per student)		4		250				250	250
Total			12	07	160	290	40	10	200	325	500

Ag. Econ 505 - Agricultural Marketing and Price Analysis**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

Suggested Readings

Purecell WD & Koontz SR. 1999. *Agricultural Futures and Options: Principles and Strategies*. 2nd Ed. Prentice-Hall.

Rhodes VJ. 1978. *The Agricultural Marketing System*. Grid Publ., Ohio.

Shepherd SG & Gene AF. 1982. *Marketing Farm Products*. Iowa State Univ. Press.

Singhal AK. 1986. *Agricultural Marketing in India*. Annual Publ., New Delhi.

Ag. Econ 507- Econometrics**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

Introduction – relationship between economic theory, mathematical economics, models and econometrics, methodology of econometrics-regression analysis. Basic two variable regression - assumptions estimation and interpretation approaches 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 remedial approaches - 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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

Suggested Readings

1. Gujarati DN. 2003. *Basic Econometrics*. McGraw Hill.
2. Johnson AG Jr., Johnson MB & Buse RC. 1990. *Econometrics - Basic and Applied*. MacMillan.
3. Kelejan HH & Oates WE. 1994. *Introduction to Econometrics Principles and Applications*. Harper and Row Publ.
4. Koutsoyianis A. 1997. *Theory of Econometrics*. Barner & Noble.
5. Maddala GS. 1992. *Introduction to Econometrics*. MacMillan.
6. Maddala GS. 1997. *Econometrics*. McGraw Hill.
7. Pindyck RS & Rubinfeld DL. 1990. *Econometrics Models and Econometric Forecasts*. McGraw Hill.

Ag. Econ. 516 - Farm Management Economics**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 06**

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.

Suggested Readings

1. Sankayan PL. 1983. *Introduction to Farm Management*. Tata Mc Graw Hill.
2. Johl S.S. and Kapoor T.R. 2003. *Fundamentals of Farm Business Management*. Kalyani Publishers.

Stat 421-- Statistical Methods for Research Workers**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

Suggested Readings

1. Black TR. 1993. *Evaluating Social Science Research - An Introduction*. SAGE Publ.
2. Creswell JW. 1999. *Research Design - Qualitative and Quantitative Approaches*. SAGE Publ.
3. Dhondyal SP. 1997. *Research Methodology in Social Sciences and Essentials of Thesis Writing*. Amman Publ. House, New Delhi.
4. Kothari CR. 2004. *Research Methodology - Methods and Techniques*. Wishwa Prakashan, Chennai.
5. Rao KV. 1993. *Research Methodology in Commerce and Management*. Sterling Publ., New Delhi.
6. Singh AK. 1993. *Tests, Measurements and Research Methods in Behavioural Sciences*. Tata McGraw-Hill.
7. Venkatasubramanian V. 1999. *Introduction to Research Methodology in Agricultural and Biological Sciences*. SAGE Publ.

Minor Agronomy 422: Crop Ecology**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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 farming; 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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 06**

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;

Ag Econ. 504 Agricultural Production Economics**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 06**

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.

Suggested Readings

1. Beattie BR & Taylor CR. 1985. *The Economics of Production*. John Wiley & Sons.
2. Doll JP & Frank O. 1978. *Production Economics - Theory and Applications*. John Wiley & Sons.
3. Gardner BL & Rausser GC. 2001. *Handbook of Agricultural Economics*. Vol. I. *Agricultural Production*. Elsevier.
4. Hedy EO. *Economics of Agricultural Production and Resource Use*. Prentice-Hall.

Ag. Econ. 506-- Research Methodology for Social Sciences**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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

Max. Marks = 50

Practical = 40

Int. Assess. = 10

Periods per week = 03

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.

Suggested Readings

1. Black TR. 1993. *Evaluating Social Science Research - An Introduction*. SAGE Publ.
2. Creswell JW. 1999. *Research Design - Qualitative and Quantitative Approaches*. SAGE Publ.
3. Dhondyal SP. 1997. *Research Methodology in Social Sciences and Essentials of Thesis Writing*. Amman Publ. House, New Delhi.
4. Kothari CR. 2004. *Research Methodology - Methods and Techniques*. Wishwa Prakashan, Chennai.
5. Rao KV. 1993. *Research Methodology in Commerce and Management*. Sterling Publ., New Delhi.
6. Singh AK. 1993. *Tests, Measurements and Research Methods in Behavioural Sciences*. Tata McGraw-Hill.
7. Venkatasubramanian V. 1999. *Introduction to Research Methodology in Agricultural and Biological Sciences*. SAGE Publ.

Ag. Econ. 509-- Agricultural Finance and Project Management**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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.

Practical**Time: 3 Hours****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

Suggested Readings

1. Dhubashi PR. 1986. *Policy and Performance - Agricultural and Rural Development in Post Independent India*. Sage Publ.
2. Gittinger JP 1982. *Economic Analysis of Agricultural Projects*. The Johns Hopkins Univ. Press.
3. Gupta SC. 1987. *Development Banking for Rural Development*. Deep & Deep publ.
4. Little IMD & Mirlees JA. 1974. *Project Appraisal and Planning for Developing Countries*. Oxford & IBH Publ.
5. Muniraj R. 1987. *Farm Finance for Development*. Oxford & IBH Publ.

Minor Agron 451 (Opt. i): Farm Cropping System**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 06**

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. Agric. Vegetable 421 (Opt. ii): Fundamentals of Vegetable Production**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.

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: Vegetable: 421**Time: 3 Hours****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week (Pract) : 06**

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.

Ag. Econ. 508 LINEAR PROGRAMMING**Time: 3 Hours****Max. Marks: 100****Theory= 80****Int. Assess: 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.**

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****Max. Marks = 50****Practical = 40****Int. Assess. = 10****Periods per week = 03**

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.

Suggested Readings

1. Dorfman R. 1996. *Linear Programming & Economic Analysis*. McGraw Hill.
2. Loomba NP. 2006. *Linear Programming*. Tata McGraw Hill.
3. Shenoy G. 1989. *Linear Programming-Principles & Applications*. Wiley Eastern Publ. 46 Vaserstein.

M. Sc. Agric. Ag. Econ.501: Micro Economics**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 20****Periods per week (Th.): 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 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.

Suggested Readings

1. David M Kreps 1990. A Course in Microeconomic Theory. Princeton University Press.
2. Dewitt KK 2002. Modern Economic Theory. Sultan Chand & Co.
3. Henderson JM & Quandt RE 2000. Microeconomic Theory : A Mathematical Approach, McGraw-Hill.
4. Koutsoyiannis A. 2003. Modern Microeconomics. The Macmillan press.
5. Silberberg E & Suen W. 2001. The Structure of Economics- A Mathematical Analysis. McGraw-Hill.
6. Varian Hal R. 1999. Intermediate Microeconomics. Affiliated East-West Press

M. Sc. Agric. Econ. 503 Evolution of Economic Thought**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.**

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 Malthus and 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 Walras. 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 growth 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.

Suggested Readings:

1. Blaug M. 1964. Economic Theory in Retrospect. Heineman.
2. Blaug M. 1986. Economic History and the History of Economic Thought Wheatsheaf Books, Brighton.
3. Ekelund RB & Hobart RF. 1975. A History of Economic Theory and Method, McGraw-Hill.
4. John Mills A. 2002. Critical History of Economics: Missed Opportunities. Palgrave Macmillan.
5. Screpanti E & Zamagni S. 1995. An Outline of the History of Economic Thought. Clarendon Press, Oxford.

M. Sc. Agric. Ag. Econ. 514 Rural Marketing**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.**

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 rural market in India.

Suggested Readings:

1. Krishnalacharyulu CSG & Ramakrishan L. 2002. Rural Marketing. Pearson Edu.
2. Ramaswamy VS & Nanakumari S. 2006. Marketing Management. 3rd Ed, MacMillan.
3. Singh AK & Pandey S. 2005. Rural Marketing. New Age.
4. Singh Sukhpal 2004. Rural Marketing. Vikas Publ. House.

M. Sc. Agric. Opt (i) Minor Supporting 521 Mgt: Agric -Business Management**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.**

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.

M. Sc. Agric. Opt (ii) Minor Supporting 524 Stat: Sampling Theory**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 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.**

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.

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 ancillary 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.

M. Sc. Agric. Econ. 502 Macro Economics and Policy**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 20****Periods per week (Th.): 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.**

Nature and Scope of Macro Economics. National Income - concepts and measurement. Classical theory of Employment and Say's Law. Modern theory of Employment and Effective Demand. Consumption function. Investment and savings. Concept of Multiplier and Accelerator. Output and Employment. Rate of interest - Classical, Neo classical and Keynesian version, Classical theory Vs Keynesian theory. Unemployment and Full employment. Money-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.

Suggested Readings:

1. Ahuja HL. 2007. Macroeconomics: Theory and Policy. S. Chand & Co.
2. Eugene A Diulio"2006. Macroeconomics. 4th Ed. Schaums' Outlines.
3. Gardner Ackely 1987. Macro Economic: Theory and Policy. Collier Macmillan
4. Dornbusch. 2006. Macroeconomics. McGraw Hill Publication

M. Sc. Agric. Ag. Econ. Econ. 511 Agricultural Development and Policies**Time: 3 Hours****Max. Marks: 100****Theory: 80****Int. Assess.: 20****Periods per week (Th.): 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.**

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. . .

Suggested Readings:

1. Chakaravathi RM. 1986. Under Development and Choices in Agriculture. Heritage Pub. New Delhi.
2. Diwett KK. 2002. Modern Economic Theory. S. Chand & Co.
3. Eicher KC & Staatz JM. 1998. international Agricultural Development. Johns Hopkins Univ. Press.
4. Frank E. 1992. Agricultural Policies in Developing Countries. Cambridge Univ. Press.
5. Ghatak S & Ingersent K. 1984. Agriculture and Economic Development. Select Book Service Syndicate, New Delhi.

Practical: Opt (i) Minor Supporting 521 Mgt: Agric -Business Management**Time: 3 Hours****Max. Marks: 50****Practical: 40****Int. Assess.: 10****Periods per week (Prt.): 03**

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.

Practical: Opt (ii) Minor Supporting 524 Stat: Sampling Theory**Time: 3 Hours****Max. Marks: 50****Practical: 40****Int. Assess.: 10****Periods per week (Prt.): 03**

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

M. Sc. Agric. Ag.Econ: RESEARCH WORK Total Marks: 250