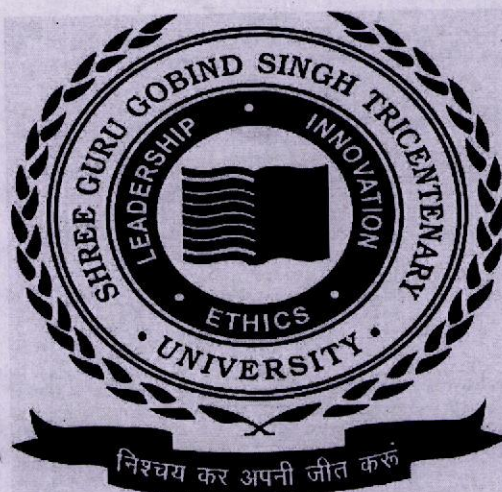


# **FACULTY OF AGRICULTURAL SCIENCES**

**ORDINANCE**

**M.Sc. Agriculture**

**(2020-21)**




**SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY  
GURUGRAM (DELHI-NCR)**

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## COURSE ORDINANCE

### 1. PREAMBLE

The higher education system in the country has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and equality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and equality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvements in the higher educational system.

Faculty of Agricultural Sciences, Shree Guru Gobind Singh Tricentenary University, Gurugram with the aim to enhance academic standards in quality of higher education has adopted the UGC/ICAR guidelines for all PG courses.

The grading system is considered to be better than the conventional marks system and in order to facilitate students' mobility across institutions within India and across countries the cumulative grade point average (CGPA) has been introduced in the PG courses.

### CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional percentage system. Therefore, it is imperative to introduce uniform grading system in the entire higher educational in India. This will benefit the students to move across institutions within India and across countries as well. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Commulative Grade Point Average (CGPA) based on student's performance in examination, the UGC/ICAR has formulated the guidelines to be followed.

#### Outline of choice Based Credit System:

- a. **Core/Major Courses:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core Course.
- b. **Minor subject:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provide and extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency.
- c. **Advisory Committee:** Minimum three members (two from major subject including chairman and one from minor subject) to be constituted within 12 weeks of first semester.
- d. **Synopsis:** A brief outline of proposed project should be accomplished in the first semester by a student in consultation with advisory committee. Student will present the same before advisory committee for suggestion and submitted to Dean FASC for approval.
- e. **Thesis:** A research project is assigned to PG scholar as per his/her interest with a support of advisory committee consisting of faculty members is called thesis.
- f. **Supporting subject:** The subject is not related to major subject. It could be any subject considered relevant for student research work or necessary for building his/her overall competence.
- g. **Skill Enhancement Course:** These six non credit compulsory courses are of general nature and are compulsory for Masters programme.



## 20. Credit Based Grading System:

### i. Key Definitions:

Programme	An educational programme leading to award of a Degree, Diploma or certificate.
Course	Usually referred to as 'paper' is a component of a programme. All courses need not carry the same weight.
Credit	A unit by which the course work is measured. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours for practical work/field work per week. A research Based Paper/Project is equal to 5 credits.
Credit Point	It is the product of grade point and number of credits for a course i.e. credit point = No. of credits in a course x "grade value" of the grade obtained in the course.
Grade Point Average(GPA)	There are two types of GPAs as given here under: Semester Grade Point Average (SGPA) Cumulative Grade Point Average (CGPA) Every student earns a distinct SGPA and a distinct CGPA at the end of each specified semester.
SGPA	SGOA is a measure for performance of student in a semester. It is the Point Average ratio of sum of the product of number of credits with grade points scored by the student in all the courses taken by him/her and the sum of the number of credits of all the courses undergone by the student i.e. $SGPA(Si) = \sum(Ci \times Gi) / \sum Ci$
CGPA	CGPA is a measure of performance up to any Grade. Grade specified semester Point Average beginning from the first semester. It is also calculated in the same (CGPA) manner as SPGA taking into account all the courses undergone by a student over all the semesters of programme i.e. $CGPA = \sum(Ci \times Si) / \sum Ci$
Grade Point	It is a numerical weight allotted to each letter grade on a 10-point scale
Letter Grades	It is an index of the performance of a student in a said course. The Grades are denoted by letters O, A+, A, B+

### ii. Credits, Semesters, Courses and Total Credit Points:

S.No.	Course	Semesters	Major Credits	Minor Credits	Supporting Credit	Research Credit
1	M.Sc. Ag. (Agronomy)	4	21	9	5	20
2	M.Sc. Ag. Horticulture (Fruit Science)	4	21	9	5	20
3	M.Sc. Ag. Horticulture (Vegetable Science)	4	21	9	5	20
4	M.Sc. Ag. (Plant Pathology)	4	21	9	5	20

### Grading Table

Range of Percentage of Marks	Letter Grade	Grade Point	Range of Grade Points	Classifications
90 and above	O (Outstanding)	10	9-10	Outstanding
80 & above but less than 90	A+ (Excellent)	9	8 < 9	Excellent
70 & above but less than 90	A (Very Good)	8	7 < 8	1 <sup>st</sup> Div with Distinction
60 & above but less than 70	B+ (Good)	7	6 < 7	1 <sup>st</sup> Division
Less than 60	F (Fail)	0	0	Fail

Formula for calculating percentage of marks:



## M.Sc. Ag. (Agronomy)

  
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## 1. Executive Summary

The role of agronomy is significant in agro eco-system. Understanding the growth, development, mechanisms of photosynthesis, photorespiration, nitrogen fixation and other metabolic pathways, behaviour of enzymes, development of fermentation technologies and modern biology tools have changed the trend in agronomical research. The advancement made in last few decades in agronomy is now reflected in teaching and research in allied agricultural sciences. There has been more use of modern techniques in crop production, mineral nutrition, chemical analysis of soil, plant and various agricultural products. Courses on cereals, pulses, oilseeds, weed management, climatology, fertilizer management, organic farming, irrigation management, water shed management and crop modeling has become necessary for improving the quality of education leading to post graduates passing out with applied knowledge including skill and entrepreneurship. Haryana is primarily an agricultural state with 70% of population pre-dominantly engaged in agriculture. Haryana is self-sufficient in food production and the second largest contributor to India's central pool of food grains with the scope of education to sustain productivity and soil fertility. The main crops of Haryana are wheat, rice, sugarcane, cotton, oilseeds, gram, barley, corn and millet etc.

The existing M.Sc. Ag. (Agronomy) programme running at national level is inadequate to meet the present and envisaged human resource requirement. The programme needs to be expanded as done in the Syllabus of Agronomy in Agricultural Scientists Recruitment Board (ASRB) Examinations. The envisaged M. Sc. programmes are:

### 1.1. Organization of Course Contents & Credit Requirements

#### 1.1.1. General Information about Course Code Numbers

- i). All courses for M.Sc. Ag. (Agronomy) are of 500-series.
- ii). Credit seminar has been designated by code no. 591, while code no. 599 pertains for Master's Research.

#### 1.1.2. General Information about Course Contents

The contents of each course have been organized into:

- i). Objective (s) – to elucidate the basic purpose.
- ii). Theory units – to facilitate uniform coverage of syllabus for paper setting.
- iii). Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.

#### 1.1.3. Minimum Credit Requirement

Subject*	Master's Programme
Major	20
Minor	09
Supporting	05
Seminar	01
Research	20
Total Credits	55
Compulsory Non Credit Courses	Section 5

\*Major subject: The subject (discipline) in which the students takes admission.

Minor subject: The subject closely related to major subject.



Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.

Non-Credit Compulsory Courses: Please see Section 5 for details. Six courses are of general nature and are compulsory for Master's programme.

## 2. MAJOR SUBJECT

### 2.1. Courses' Structure at a Glance

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
AGRON 501*	11060108	MODERN CONCEPTS IN CROP PRODUCTION	3(3+0)
AGRON 502*	11060207	PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT	3(2+1)
AGRON 503*	11060209	PRINCIPLES AND PRACTICES OF WEED MANAGEMENT	3(2+1)
AGRON 504*	11060210	PRINCIPLES AND PRACTICES OF WATER MANAGEMENT	3(2+1)
AGRON 505	11060109	AGROMETEOROLOGY AND CROP WEATHER FORECASTING	3(2+1)
AGRON 506	11060110	AGRONOMY OF MAJOR CEREALS AND PULSES	3(2+1)
AGRON 511	11060211	CROPPING SYSTEM	2(2+0)
AGRON 591	11060405	MASTER'S SEMINAR	1(1+0)
AGRON 599	11060406	MASTER'S RESEARCH	

\*Compulsory Course

# Course numbers are as per ICAR recommendation and guidelines.

#### 2.1.1 Course Content

##### 11060108: MODERN CONCEPTS IN CROP PRODUCTION 3(3+0)

##### Objective

To teach the basic concepts of soil management and crop production.

##### Theory

##### UNIT-I

Crop growth analysis in relation to environment; geo-ecological zones of India.

##### UNIT-II

Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.

##### UNIT-III

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.

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- Tisdale SL, Nelson WL, Beaton JD & Havlin JL. 1997. *Soil Fertility and Fertilizers*. Prentice Hall.

### 3. MINOR SUBJECT (Soil Science)

#### 3.1. Courses' Structure at a Glance

Course (ICAR pattern)	Code	Course (SGTU pattern)	Code	Course Title	Credits
SOILS 505		11060403		SOIL EROSION AND CONSERVATION	3(2+1)
SOILS 511		11060105		ANALYTICAL TECHNIQUES AND INSTRUMENTAL METHODS IN SOIL AND PLANT ANALYSIS	2(0+2)
SOILS 513		11060112		MANAGEMENT OF PROBLEMATIC SOILS AND WATERS	3(2+1)
SOILS 514		11060402		FERTILIZER TECHNOLOGY	1(1+0)

##### 3.1.1. Course Content

#### 11060403: SOIL EROSION AND CONSERVATION 3(2+1)

##### Objective

To enable students to understand various types of soil erosion and measures to be taken for controlling soil erosion to conserve soil and water.

##### Theory

##### UNIT-I

History, distribution, identification and description of soil erosion problems in India.

##### UNIT-II

Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; raindrops and soil erosion; rainfall erosivity - estimation as EI30 index and kinetic energy; factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in relation to soil properties and precipitation.

##### UNIT-III

Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country.

##### UNIT-IV

Principles of erosion control; erosion control measures – agronomical and engineering; erosion control structures - their design and layout.

##### UNIT-V

Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.

##### UNIT-VI

Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds; use of remote sensing in assessment and planning of watersheds.



- Determination of cations (Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>++</sup> and Mg<sup>++</sup>) in ground water and soil samples
- Determination of anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>--</sup>, CO<sub>3</sub><sup>--</sup> and HCO<sub>3</sub><sup>-</sup>) in ground waters and soil samples
- Lime and gypsum requirements of acid and sodic soils

### Suggested Readings

- Bear FE. 1964. *Chemistry of the Soil*. Oxford & IBH.
- Jurinak JJ. 1978. *Salt-affected Soils*. Department of Soil Science & Biometeorology. Utah State Univ.
- USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline and Alkali Soils*. Oxford & IBH.

## 11060402: FERTILIZER TECHNOLOGY 1(1+0)

### Objective

To impart knowledge about how different fertilizers are manufactured using different kinds of raw materials and handling of fertilizers and manures.

### Theory

#### UNIT-I

Fertilizers – production, consumption and future projections with regard to nutrient use in the country and respective states; fertilizer control order.

#### UNIT-II

Manufacturing processes for different fertilizers using various raw materials, characteristics and nutrient contents.

#### UNIT-III

Recent developments in secondary and micronutrient fertilizers and their quality control as per fertilizer control order.

#### UNIT-IV

New and emerging issues in fertilizer technology – production and use of slow and controlled release fertilizers, super-granules fertilizers and fertilizers for specific crops/situations.

### Suggested Readings

- Brady NC & Weil RR. 2002. *The Nature and Properties of Soils*. Pearson Edu.
- *Fertilizer (Control) Order, 1985 and the Essential Commodities Act*. FAI New Delhi.
- Kanwar JS. (Ed.). 1976. *Soil Fertility: Theory and Practice*. ICAR.
- Olson RA, Army TS, Hanway JJ & Kilmer VJ. 1971. *Fertilizer Technology and Use*. 2nd Ed. Soil Sci. Soc. Am. Madison.
- Prasad R & Power JF. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.
- Tisdale SL, Nelson SL, Beaton JD & Havlin JL. 1999. *Soil Fertility and Fertilizers*. McMillan Publ.
- Vogel AI. 1979. *Textbook of Quantitative Inorganic Analysis*. ELBS.

## 4. BASIC SUPPORTING COURSES

### 4.1. Courses' structure at a Glance

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
STAT 512	11060203	EXPERIMENTAL DESIGNS	3(2+1)
STAT 513	11060308	SAMPLING TECHNIQUES	3(2+1)



## M.Sc. Ag. Horticulture (Fruit Science)



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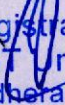
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ii). Theory units – to facilitate uniform coverage of syllabus for paper setting.

iii). Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.

iv). E-Resources - This may be useful as study material for research topics/ for quick update on specific topics/events pertaining to the subject.

### 1.1.3. Minimum Credit Requirement

Subject*	Master's Programme
Major	20
Minor	09
Supporting	05
Seminar	01
Research	20
Total Credit	55
Compulsory Non-Credit Courses	Section 5

\*Major subject: The subject (department) in which the student takes admission

Minor subject: The subject closely related to student's major subject.

Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.

Compulsory Non-Credit Courses: Please see Annexure-I for details. Six courses (PGS 501 to PGS 506) are of general nature and are compulsory for Master's programme.

## 2. Major Subject Courses

### 2.1. Courses' Structure at a Glance

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
FSC 501*	11060101	TROPICAL AND DRY LAND FRUIT PRODUCTION	3(2+1)
FSC 502*	11060102	SUBTROPICAL AND TEMPERATE FRUIT PRODUCTION	3(2+1)



FSC 503*	11060201	BIODIVERSITY AND CONSERVATION OF FRUIT CROPS	3(2+1)
FSC 505	11060302	PROPAGATION AND NURSERY MANAGEMENT FOR FRUIT CROPS	3(2+1)
FSC 506*	11060301	BREEDING OF FRUIT CROPS	3(2+1)
FSC 507	11060103	POST HARVEST TECHNOLOGY FOR FRUIT CROPS	3(2+1)
FSC 512	11060303	GAP FOR HORTICULTURAL CROPS	1(1+0)
FSC 513	11060104	CLIMATE MANAGEMENT IN HORTICULTURAL PRODUCTION	1(1+0)
FSC 591	11060405	MASTER'S SEMINAR	1(1+0)
FSC 599	11060406	MASTER'S RESEARCH	20

\* Compulsory Course

### 2.1.1 Course Content

#### FSC 501/11060101: TROPICAL AND DRY LAND FRUIT PRODUCTION 3(2+1)

##### Objective

To impart basic knowledge about the importance and management of tropical and dry land fruits grown in India.

##### Theory

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bio-regulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, honeybees in cross pollination, physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones (AEZ) and industrial supports.

##### Crops

##### UNIT-I

Mango and Banana

##### UNIT-II

Citrus and Papaya

##### UNIT-III

Guava, Sapota and Jackfruit

##### UNIT-IV

Pineapple, Annonas and Avocado

##### UNIT-V

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## Theory

### UNIT-I

Introduction to climate change. Factors directly connected to climate change, average temperature, change in rainfall amount and patterns, rising atmospheric concentrations of CO<sub>2</sub>, pollution levels such as tropospheric ozone, change in climatic variability and extreme events like receding of glaciers in Himalayas.

### UNIT-II

Sensors for climate registration and crop monitoring, phytomonitoring and biosensors, plants response to the climate changes, premature bloom, marginally overwintering or inadequate winter chilling hours, insect pests, longer growing seasons and shifts in plant hardiness for perennial fruit crops, flowering plants and other plant species.

### UNIT-III

Impact of climate changes on invasive insect, disease, weed, pests, horticulture yield, quality and sustainability, climate management in field production – mulching - use of plastic- windbreak- spectral changes- frost protection. Climate management in greenhouse- heating - vents - CO<sub>2</sub> injection - screens - artificial light.

### UNIT-IV

Climate management for control of pests, diseases, quality, elongation of growth and other plant processes- closed production systems around the world. Special protected cultivation now and in the future, growth chambers, production in space, biosphere, future aspects of close production, future greenhouse, use of LED as artificial light, future sensor types etc. clean development mechanism, role of tropical trees.

### Suggested Readings

- Peter KV. 2008. (Ed.). *Basics of Horticulture*. New India Publ. Agency.
- Rao GSLHV, Rao GGSN, Rao VUM & Ramakrishnan YS. 2008. *Climate Change and Agriculture over India*. ICAR.
- Rao GSLHV. 2008. *Agricultural Meteorology*. Prentice Hall.

### 3. Minor Subject(s)


The student admitted for M.Sc. Ag. Horticulture (Fruit Science) Degree Program will study Vegetable Science as the minor subject.

#### 3.1. Courses' Structure at a Glance

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
VSC 501	11060202	PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS	3(2+1)
VSC 502	11060304	PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE CROPS	3(2+1)
VSC 505	11060401	SEED PRODUCTION TECHNOLOGY OF VEGETABLE CROPS	3(2+1)



## M.Sc. Ag. Horticulture (Vegetable Science)

  
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6.2. Course Structure: 2<sup>nd</sup> Semester

6.3. Course Structure: 3<sup>rd</sup> Semester

6.4. Course Structure: 4<sup>th</sup> Semester

### **7. E- Resources for Information on Plant Pathology**

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Keeping pace with the educational reforms, The SGTU has planned to introduce the new programmes in a phased manner and **M.Sc.Ag.Horticulture (Vegetable Science)** is the second addition after already existing M. Sc. Ag. Horticulture (Fruit Science) programme under M.Sc. Ag. Horticulture.

The newly proposed **M.Sc. Ag. Horticulture (Vegetable Science)** programme will be on similar pattern as suggested by ICAR. Core and optional courses for vegetable crops have been included in the syllabus. Production technology, breeding and seed production of crops are covered under core courses. Introduction and history have been avoided from the syllabi as these are already covered at graduate level. Recent advances in biotechnology and protected cultivation, marker-assisted breeding, IPR issues, patenting, organic crop production and GAP are included in the syllabus. Production technology of underexploited crops and abiotic stress management has also been considered as relevant topics for PG curriculum. Reference section is enriched with the latest text books on the concerned subjects.

### **1.1. Organization of Course Contents & Credit Requirements**

#### **1.1.1. General Information about Course Code Numbers**

- i). All courses for M.Sc. Ag. Horticulture (Vegetable Science) will be of 500-series.
- ii). Credit seminar has been designated by code no. 591, while code no. 599 pertains for Master's Research.

#### **1.1.2. General Information about Course Contents**

The contents of each course have been organized into:

- i). Objective (s) – to elucidate the basic purpose.
- ii). Theory units – to facilitate uniform coverage of syllabus for paper setting.
- iii). Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.
- iv). E-Resources - This may be useful as study material for research topics/ for quick update on specific topics/events pertaining to the subject.

#### **1.1.3. Minimum Credit Requirement**

<b>Subject*</b>	<b>Master's Programme</b>
Major	20
Minor	09
Supporting	05
Seminar	01
Research	20



Total Credit	55
Compulsory Non-Credit Courses	Section 5

\*Major subject: The subject (department) in which the student takes admission

Minor subject: The subject closely related to student's major subject.

Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.

Compulsory Non-Credit Courses: Please see Section 5 for details. Six courses (PGS 501 to PGS 506) are of general nature and are compulsory for Master's programme.

## 2. Major Subject Courses

### 2.1. Courses' Structure at a Glance

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
VSC 501*	11060202	PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS	3(2+1)
VSC 502*	11060304	PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE CROPS	3(2+1)
VSC 503*	11060212	BREEDING OF VEGETABLE CROPS	3(2+1)
VSC 504*	11060213	GROWTH AND DEVELOPMENT OF VEGETABLE CROPS	3(2+1)
VSC 505	11060401	SEED PRODUCTION TECHNOLOGY OF VEGETABLECROPS	3(2+1)
VSC 506	11060114	SYSTEMATICS OF VEGETABLE CROPS	2(1+1)
VSC 507	11060113	PRODUCTION TECHNOLOGY OF UNDER-EXPLOITED VEGETABLE CROPS	2(1+1)
VSC 508	11060310	ORGANIC VEGETABLE PRODUCTION TECHNOLOGY	2(1+1)
VSC 509	11060309	FUNDAMENTALS OF PROCESSING OF VEGETABLES	2(1+1)
VSC 591	11060405	MASTER'S SEMINAR	1(1+0)
VSC 599	11060406	MASTER'S RESEARCH	20

\* Compulsory Course



Study of biochemical changes and enzymes associated with spoilage; Laboratory examination of vegetable products; Sensory evaluation of fresh and processed vegetables; Study of food standards – National, international, CODEX Alimentarius; Visit to processing units to study the layout, equipment, hygiene, sanitation and residual / waste management.

### Suggested Readings:

- Arthey D & Dennis C. 1996. Vegetable Processing. Blackie/Springer Verlag.
- Chadha DS. 2006. The Prevention of Food Adulteration Act. Confed. of Indian Industry.
- Desrosier NW. 1977. Elements and Technology. AVI Publ. Co. FAO. 1997. Fruit and Vegetable Processing. FAO.
- FAO. CODEX Alimentarius: Joint FAO/WHO Food Standards Programme. 2nd Ed. Vol. VB. Tropical Fresh Fruits and Vegetables. FAO.
- FAO. Food Quality and Safety Systems – Training Manual on Food Hygiene and HACCP.
- FAO. Fellow's P. 1988. Food Processing Technology. Ellis Horwood International.
- Frazier WC & Westhoff DC. 1995. Food Microbiology. 4th Ed. Tata McGraw Hill.
- Giridharilal GS, Siddappa & Tandon GL. 1986. Preservation of Fruits and Vegetables. ICAR.
- Gisela J. 1985. Sensory Evaluation of Food – Theory and Practices. Ellis Horwood.
- Graham HD. 1980. Safety of Foods. AVI Publ. Co.
- Hildegrade H & Lawless HT. 1997. Sensory Evaluation of Food. CBS. Joslyn M & Heid. Food Processing Operations. AVI Publ. Co.
- Mahindru SN. 2004. Food Safety: Concepts and Reality. APH Publ. Corp.
- Ranganna S. 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw Hill.
- Shapiro R. 1995. Nutrition Labeling Handbook. Marcel Dekker.
- Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation: Principles and Practices. 3rd Ed. International Book Distrib. Co.
- Tressler & Joslyn MA. 1971. Fruit and Vegetable Juice Processing Technology. AVI Publ. Co.
- Verma LR & Joshi VK. 2000. Post-harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management. Indus Publ. Co.

### 3. Minor Subject

The student admitted for M.Sc. Ag. Horticulture (Vegetable Science) will study Fruit Science as the minor subject.

#### 3.1. Courses' Structure at a Glance

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
FSC 501	11060101	TROPICAL AND DRY LAND FRUIT PRODUCTION	3(2+1)
FSC 502	11060102	SUBTROPICAL AND TEMPERATE FRUIT PRODUCTION	3(2+1)
FSC 503	11060201	BIODIVERSITY AND CONSERVATION OF FRUIT CROPS	3(2+1)
FSC 505	11060302	PROPAGATION AND NURSERY MANAGEMENT FOR FRUIT CROPS	3(2+1)



FSC 506	11060301	BREEDING OF FRUIT CROPS	3(2+1)
FSC 507	11060103	POST HARVEST TECHNOLOGY FOR FRUIT CROPS	3(2+1)
FSC 512	11060303	GAP FOR HORTICULTURAL CROPS	1(1+0)
FSC 513	11060104	CLIMATE MANAGEMENT IN HORTICULTURAL PRODUCTION	1(1+0)

### 3.1.1.Course Contents

#### FSC 501/11060101: TROPICAL AND DRY LAND FRUIT PRODUCTION 3(2+1)

##### Objective

To impart basic knowledge about the importance and management of tropical and dry land fruits grown in India.

##### Theory

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bio-regulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, honeybees in cross pollination, physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones (AEZ) and industrial supports.

##### Crops

##### UNIT-I

Mango and Banana

##### UNIT-II

Citrus and Papaya

##### UNIT-III

Guava, Sapota and Jackfruit

##### UNIT-IV

Pineapple, Annonas and Avocado

##### UNIT-V

Ber, Aonla, Bael, Pomegranate, Phalsa, Karonda, Mulberry, Ker, Salvadoria, Lasoda and, minor fruits of tropics

##### Practical

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical and arid zone orchards, project preparation for establishing commercial orchards.



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### **7. E- Resources for Information on Plant Pathology**

  
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- Publishing, 128pp. Bridge, John S., and Starr, J. 2007. Plant Nematodes of Agricultural Importance: A Colour Handbook, Wiley February 2007.
2. Kenneth, R.H. and Nelson P.E. 1997. Compendium of Chrysanthemum Diseases, APS
  3. Parvatha, Reddy. P. 2008. Diseases of Horticultural Crops: Nematode Problems and their Management, Scientific Publishers, 380pp.
  4. Perry, R N and Moens, M 2006. Plant Nematology, CABI May 2006

### 3. Minor Subject(s)

The student admitted for M.Sc. Ag. (Plant Pathology) will study Entomology as the minor subject.

#### 3.1. Courses' Structure at a Glance

Course Code	Course Title	Credits
ENT 507/11060217	Biological Control of Crop Pests and Weeds	2(1+1)
ENT 510/11060218	Principles of Integrated Pest Management	2(1+1)
ENT 511/11060216	Major Pests of Crops and Their Management	3(1+2)
ENT 519/11060313	Commercial Entomology	2(1+1)

#### 3.1.1 Course Content

##### ENT 507/11060217: Biological Control of Crop Pests and Weeds 2(1+1)

##### Objective

To train the students in theory and practice of biological control, mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomopathogenic microorganisms.

##### Theory

##### Unit-1

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

##### Unit-2

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

##### Unit-3

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