Study Scheme & Syllabus

As per Choice Based Credit

System (CBCS)

For

M. Sc Agriculture (First to fourth Semester)

W.e.f. (Session 2017-22)

Program Code: AG 403

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SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places and a centre of excellence to promote and nurture future leaders who would facilitate the desired change in the society.

MISSION

- To impart teaching and learning through cutting-edge technologies supported by the world class infrastructure
- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values.

SECTION 2

Vision and Mission of the Department

VISION

To visualize a great future for the youth with innovative nature, research culture and ethics so that they can meet the global challenges and improve the quality of human life.

MISSION

- To meet the need of students by providing educational experiences in the field of agriculture.
- To focus on offering a broad undergraduate and postgraduate curriculum consisting of various subjects in Agricultural Science like Agronomy, Plant Protection, Agribusiness Economics, Agricultural Education, Agricultural System Technology, Horticulture, Animal Science *etc*.
- To integrate educational experience that blends fundamentals, research and hands-on experience.

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SECTION 3

About the Program

It is an Outcome Based Education model which is a 2 year, 4 Semester Full time Program of 141+78 NC credit hours with a Choice Based Credit System (CBCS) and Grading Evaluation System. It is a professional degree recognized by the Government of India in the field of agricultural science. This course aims to provide training to implement modern agricultural techniques and innovations from lab to farmer's field. It deals with various specialisations such as agronomy, horticulture and plant pathology.

Credit System

		Range	Grade	Grade Points	Qualitative Meaning
60	25%	90-100	O	10	Outstanding
		80-89	A	9	Excellent
		70-79	B	8	Good
		60-69	C	7	Pass
		Less then 60	F	0	Fail
		Absent	AB	0	AB

SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO1	The subject revolves around the scientific study of agriculture. This will help to improve the quality of the yield and will also increase the production rate.
PEO2	The course also provides an integrated understanding of economic and social considerations in the agricultural systems.
PEO3	To develop a good teaching-learning environment for higher studies and help in selection of professional careers in government and private organization, agro-based industries, educational/ research/extension, institutes etc.
PE04	The students will get excellent job offers in areas like Agriculture/Dairy Industries, Fertilizer Industries, and Food Processing Units.

PROGRAMME OUTCOMES (POs)

Program Name	M. Sc Agriculture
Program Code	AG 403
Program Credits	141+78 NC
Number of Semesters	Total 4 semester in 2 years
Program Outcomes(PO): on successful completion of this Program, the learner will be able to:	
PO 1	To impart first and knowledge on agriculture and allied sciences
PO 2	To impart in-depth practical knowledge in agriculture and allied sciences
PO 3	To disseminate different technologies through various extension activities
PO 4	To Understand the impact of the professional agricultural solution in societal and environmental context.
PO 5	***Team Work*** : Play effective roles in multidisciplinary teams.
PO 6	***Educational Leadership*** : Recognize and meet emerging agriculture challenges of global society in the 21st century and developing leadership and strong linkages in the agro-industrial setup.
PO 7	***Ethics*** : Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.
PO 8	***Computational Skills*** : Recognize, analyze problems and plan strategies for their solutions with the help of computer skills
PO 9	***Data Handling*** : Collect, analyze and interpret scientific data.
PO 10	To make students competitive in pursuing higher studies
PO 11	To provide knowledge on commercial agricultural production practices
PO 12	This programme will also help students to enhance their employability for jobs in Different sectors.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Program specific Outcomes(PSO)	
PSO 1	To provide knowledge on working of different farm implements
PSO 2	Detailed knowledge on horticulture, agronomy and plant pathology practices

A: Mapping Scale:-
Scale of mapping between COs and POs

Scale	
0	Zero correlation between the content of course and particular program outcome
1	Low correlation between the content of course and particular Program outcome
2	Medium correlation between the content of course and particular Program outcome
3	High correlation between the content of course and particular Program outcome

SECTION 5

Curriculum / Scheme with Examination Grading Scheme

SEMESTER WISE SUMMARY OF THE PROGRAMME: M.Sc. Agronomy

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	23	1000	18
2.	II	18+3NC	800	16+3NC
3	III	16+7NC	800	12+7NC
4	IV	2+16NC	100	2+16NC
	Total	**59+26NC**	**2700**	**48+26NC**

SEMESTER WISE SUMMARY OF THE PROGRAMME: M.Sc. Horticulture

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	23	1000	18
2.	II	19+3NC	900	15+3NC
3	III	16+7NC	700	12+7NC
4	IV	2+16NC	100	2+16NC
	Total	**59+26NC**	**2700**	**48+26NC**

SEMESTER WISE SUMMARY OF THE PROGRAMME: M.Sc. Plant Pathology

Program Name: M. Sc Agriculture
Program Code: AG 403

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	24	800	18
2.	II	20+3NC	1000	15+3NC
3	III	14+7NC	700	11+7NC
4	IV	2+16NC	100	2+16NC
	Total	**59+26NC**	**2700**	**48+26NC**

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A+	9	Excellent
60-69	A	8	Very Good
55-59	B	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Fail
0-39	F	0	Fail
ABSENT	AB	0	Fail

Percentage Calculation: CGPA *10

Program Name: M. Sc Agriculture
Program Code: AG 403

Examination Grading Scheme is different for different programs. It has to be changed by the department

The text highlighted yellow is for instruction and will not be included in the final format.

Program Name: M. Sc Agriculture
Program Code: AG 403

FIRST SEMESTER

M.Sc. Agriculture (Agronomy)

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
Core Courses											
AGRO-5111	Agro-meteorology and Crop Weather Forecasting	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGRO-5112	Principles and Practices of Water Management	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGRO-5113	Principles and Practices of Soil Fertility and Nutrient Management	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
APPP-5111	Principles of Plant Physiology	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SOIL-5111	Management of Problematic Soils and Water	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Total		**13**	**0**	**10**	**18**						

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid Term Exam

ETE End Term Exam

SECTION 6

Detailed Syllabus with Course Outcomes

SYLLABUS

SEMESTER-I

Detailed Syllabus

SEMESTER I

SUBJECT TITLE: Agro-meteorology and Crop Weather Forecasting
SUBJECT CODE: AGRO-5111
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40

End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart knowledge about agro-meteorology and crop weather forecasting to meet the challenges of aberrant weather conditions.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Agro-meteorology: aim, scope and development in relation to crop environment, composition of atmosphere, distribution of atmospheric pressure, Solar radiation : characteristics, energy balance of atmosphere system, radiation distribution in plant canopies, radiation utilization by field crops, photosynthesis and efficiency of radiation utilization by crops, energy budget of plant canopies.	**15**
UNIT-II	Environmental temperature: soil, air, canopy temperature, temperature profile in air, soil and crop canopies, soil and air temperature effects on plant processes, regulation of air, soil temperature for protection against frost and hot winds, Environmental moisture and evaporation, measures of atmospheric moisture, temperature, relative humidity, vapour pressure and their relationship, evapo-transpiration and meteorological factors determining evapo-transpiration.	**15**
UNIT-III	Modification of plant environment: artificial rain making, controlling heat load, heat trapping and shedding, protection from cold, reduction in sensible and latent heat flux, Monsoon: monsoon and their origin, characteristics of monsoon, onset and progress of monsoon, withdrawal of monsoon, Weather forecasting in India: short, medium and long range forecasting, benefits of weather service to agriculture, forecasting of destructive frost, soil moisture forecast, phenological forecast, crop yield forecast, Aero-space science and remote sensing : application in agriculture, present status of remote sensing in India, Atmospheric pollution and its effect on climate and crop production.	**15**
	PRACTICAL	
	• Agro-meteorological observatory- classes, site selection, layout and installation of meteorological instruments; handling of meteorological instruments; measurement of weather parameters; working out agro-climatic indices; maintenances of	**30**

	record; calculation of daily, weekly and monthly means. • Visit to state remote sensing centre, P.A.U Campus, Ludhiana; measurement of soil temperature in different soil conditions/depths; interpretation and use of weather data; rainfall analysis for variability; moisture availability indices for an arid and a humid district, length of growing season, fitting cropping systems. • Preparation of weather maps, synoptic charts and weather reports; preparation of crop weather calendars, to become familiar with agro advisory service bulletins visit to Agriculture Research Stations.	

Course Outcomes:

After taking the course, students will be able to:

1. Students will gain knowledge on agro meteorology and its different variables on crop production.
2. To understand the onset and withdrawal of monsoon and crop seasons. To gain knowledge about evapo transpiration and its effect on crop production.
3. To understand weather forecasting and weather in relation to pest and disease management.
4. To design crop weather calendar for various agro climatic zones

Recommended Books:

1. Mavi, S (1994). Introduction to Agrometeorology. Oxford & IBH Publishing Co. New Delhi.
2. Menon, P.A. (1989). Our weather. National Book Trust, New Delhi.
3. Rama Sastu, A.A. (1984). Weather and Weather forecasting Publication Division, GOI.
4. Das, P.K. (1992). The Monsoon. National Book Trust, New Delhi.
5. Venkateraman, S. and Krishnan, A. Crops and Weather. Indian Council of Agricultural Research, New Delhi.
6. Critchfield, H.J. (1995). General Climatology, Prentice Hall of India Pvt. Ltd., New Delhi
7. Mavi H S. (2003) Introduction To Agrometeorology, Oxford &IBH

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Principles and Practices of Water Management
SUBJECT CODE: AGRO-5112
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Water, its properties and role in plants; Water resources of India, Major irrigation projects and extent of area and crops irrigated in India; Water potential – concept, components and relationship between different components; Water movement in plant and soils; Absorption and transpiration of water in plants.	**15**
UNIT-II	Scheduling and methods of irrigation including micro irrigation system; Fertigation, Water use efficiency: Water management of crops and cropping systems; Soil, plant and meteorological factors deter mining water needs of crops.	**15**
UNIT-III	Water deficit stress in plants and its effect on growth. Quality of irrigation water – effect of saline water and soil salinity on plants and its management, Excess soil water and plant growth; Water management in problem soils; Drainage requirement of crops and methods of drainage, their layout and spacing.	**15**
	PRACTICAL	
	• Determination of soluble salts, Ca^{+} Mg^{-}, CO^{-} and $HCO^{-}$and Na in irrigation water; Determination of FC and PWP. • Soil moisture measurement by tensiometer and pressure plate apparatus; Water flow measurement using different devices. Determining soil profile moisture deficit and irrigation requirement. Calculations on irrigation efficiencies. • Computation of water requirement of crops using modified Penman formula. Determination of infiltration rates and hydraulic conductivity.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Classification, characters and concept of weeds. Weed growth in relation to environment and sustainability.

2. Herbicides, bio-herbicides- their classification and biological control of weeds.

3. Weed shifts in cropping systems- concept and management.

4. Control of weed in non-cropped situations using different methods

Recommended Books

1. Michael, A.M. (2000). Irrigation – Theory and Practice, Vikas Publishing House Pvt. Ltd., New Delhi
2. Parihar, S.S. and. Sandhu, B.S (1978). Irrigation of field crops – Principles and Practices, ICAR, New Delhi
3. Lenka, D. (2009). Irrigation and Drainage. Kalyani Publishers, New Delhi.
4. Mishra, R.D. and Ahmed, M. (1987). Manual on Irrigation Agronomy, Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi
5. Sankara Reddy, G.H and Yellamanda Reddy, T.. (1995). Efficient use of irrigation water. Kalyani Publishers, New Delhi
6. Paliwal, K.V. (1972) Irrigation with saline water WTC, IARI, New Delhi.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Principles and Practices of Soil Fertility and Nutrient Management
SUBJECT CODE: AGRO-5113
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Problems and management relating to mechanical impedence and soil submergence; Salt affected soils-problems and remedial measures; Soil acidity and remedial measures; Soil fertility and productivity concept and differences: Criteria of essentiality and forms in which nutrients are absorbed by plants; Physiological methods of increasing FUE.	**13**
UNIT-II	Nitrogen: Functions, deficiency and toxicity symptoms, forms of nitrogen, nitrogen transformation in soil, organic and mineral N balance in soil, mineralization of N compounds, losses of N from soil, nitrogenous fertilizer materials. Methods to increase N use efficiency and slow release fertilizers; Biological N fixation, symbiotic and free living N fixers; Phosphorus: Functions and deficiency symptoms, forms of P in soil, their availability and P fixation, various phosphatic fertilizers.	**12**
UNIT-III	Practices of increasing the effectiveness of applied and native phosphorus (PSB). Potassium: Functions and deficiency symptoms, forms of K in soil, fixation and release of potassium in soil; Potassic fertilizers and their application. Sulphur and micronutrients (Fe, Zn) functions, deficiency symptoms and application; Inter relationship of nutrient availability and soil pH; Important nutrient interactions and their effect on nutrient availability, cation exchange capacity and availability of plant nutrients; Integrated nutrient management.	**18**
	PRACTICAL	
	• Procedure of plant and soil sampling • Determination of soil pH, EC and organic carbon • Determination of total N and available N, P and K in soils • Determination of N, P, K and S in plant samples • Determination of Ca, Mg and Na in soil; Determination of gypsum requirement of alkali soils.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Gain basic knowledge of soil fertility and productivity.
2. To study Importance or Significance of soil macronutrient and micronutrients.
3. To Assess and develop importance of soil physical and chemical properties. To study about soil pollution and mitigation process
4. To study about soil pollution and mitigation process.

Suggested Books:

1. Tisdale, S.L., Nelson, W.L., Beaton, J.D. and. Havlin, J.L (1997). Soil Fertility and Fertilizers. Prentice Hall of India, Pvt. Ltd., New Delhi
2. Reddy, T.R. and. Reddi, G.H.S 1992. Principles of Agronomy, Kalyani Publishers, New Delhi
3. Richards, L.A. (1968). Diagnosis and Improvement of Saline and Alkali Soils, Oxford and IBH Publishing Company, New Delhi
4. Agarwal, R.R.,. Yadav, J.S.P and Gupta, S.N. (1982). Saline and Alkali soils of India. ICAR Publication, New Delhi.
5. Singh, G., Kolar, J.S. and Sekhon, H.S. (2002). Recent Advances in Agronomy, Indian Society of Agronomy, IARI, New Delhi.
6. Kanwar, J.S. (2003). Soil Fertility: Theory and Practices, ICAR Publication, New Delhi.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Principles of Plant Physiology
SUBJECT CODE: APPP-5111
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: The course aims at imparting knowledge about various aspects of plant physiology of plant growth regulator on growth and development of plant.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Definition and classification of plant growth regulators- Hormones, endogenous growth substances and synthetic chemicals, Site of synthesis, biosynthetic pathways and metabolism and the influence on plant growth development of individual group of hormones- Auxins, Gibberlins, cytokinins, Abscisic acid and Ethylene	**10**
UNIT-II	Endogenous growth regulating substances other than hormones; Brassinosteroids, tricontanol; Phenols – polyamines, jasmonates, concept of death hormone	**10**
UNIT-III	Synthetic growth regulators- Classification, their effect on plant growth and development; Practical utility in agriculture and horticulture.	**10**
	PRACTICAL	
	Quantification of Hormones- Principles of bioassays; Extraction of hormones from plant tissue; Auxins- bioassays- auxins effect on rooting of cuttings, abscission, apical dominance, Gibberellins- bioassays-GA effect on germination of dormant seeds, cytokinin- bioassays- estimation using immunoassay technique cytokinin effect on apical dominance and senescence, ABA bioassays estimation using immunoassay technique; ABA effect on stomatal movement, Ethylene bioassays, estimation using physico chemical techniques- effect on breaking dormancy in sunflower and groundnut.	**30**

Course Outcomes:

After taking the course, students will be able to:
1. Learn about the mineral nutrition in plants.
2. Equip students with skills and techniques related to plant physiology so that they can design their own experiments.
3. Learn about Endogenous growth regulating substances.
4. Learn about Synthetic growth regulators and quantification of hormones.

Recommended Books

1. Hopkins WG and Huner NPA. (2004). Introduction to Plant Physiology. John Wiley & Sons.
2. Salisbury FB and Ross C. (1992). Plant Physiology. 4th Ed. Wadsworth Publ.
3. Taiz L and Zeiger E. (2006). Plant Physiology. 4th Ed. Sinauer Associates.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Management of Problematic Soils and Water
SUBJECT CODE: SOIL-5111
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils in relation to using soils as a medium for plant growth.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Area, distribution, origin and basic concepts of problematic soils. Morphological features and characterization of salt-affected soils. Management of salt- affected soils. Salt tolerance of crops - mechanism and ratings.	**12**
UNIT-II	Monitoring of soil salinity in the field. Management principles for sandy, clayey, red lateritic and dry land soils. Acid soils - nature, sources and management. Effect on plant growth. Lime requirement of acid soils. .	**10**
UNIT-III	Biological sickness of soils and its management. Quality of irrigation water, management of brackish water. Salt balance under irrigation. Characterization of brackish waters, area and extent. Agronomic practices in relation to problematic soils. Cropping pattern for utilizing poor quality ground waters.	**10**
	PRACTICAL	
	Characterization of acid, acid sulfate, salt- affected and calcareous soils. Determination of cations (Na+, K+, Ca+, and Mg++) in ground water and soil samples. Determination of anions (Cl^-, SO_4^{2-}, CO_3^{2-} and HCO_3^-) in ground waters and soil samples. Lime and gypsum requirement of acid and sodic soil..	**30**

Course Outcomes:

After taking the course, students will be able to:
1. The students get knowledge about different kind of problem soil in India and their characteristics .
2. The students will understand how to control or improve the soil fertility.
3. The students gain practical knowledge of laboratory to test the problem soil.
4. The students gain practical knowledge of Characterization of brackish waters, and agronomic practices in relation to problematic soils.

Recommended Books

1. Bear F.E. (1964).. Chemistry of the Soil. Oxford & IBH.
2. Jurinak J.J. (1978). Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
3. Cirsan Paul, J. (1985). Principles of remote sensing. Longman, New York.
4. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SECOND SEMESTER

M.Sc. Agriculture (Agronomy)

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
Core Courses											
AGRO-5124	Modern Concepts in Crop Production	3	0	0	3	16	---	24	60	100	03
AGRO-5125	Principles and Practices of Weed Management	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGRO-5126	Cropping Systems and Sustainable Agriculture	3	0	0	3	16	---	24	60	100	03
SOIL-5214	Soil Fertility and Fertilizer Use	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SOIL-5217	Fertilizer Technology	2	0	0	2	16	---	24	60	100	03
AGRO-5217	Field Plot Technique	1	0	0	1	16	---	24	60	100	03
SkillEnhancementCompulsoryCourses											
AGRO-5099	Master's Research	0	0	3	3	---	---	---	---	---	---
Total		**14**	**0**	**8**	**19**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-II

Program Name: M. Sc Agriculture
Program Code: AG 403

SEMESTER II

SUBJECT TITLE: Modern Concepts in Crop Production
SUBJECT CODE: AGRO-5124
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To teach the basic concepts of soil management and crop production.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Agronomic aspects in food security; Crop growth and production in relation to climate change; Agro ecological and agroclimatic zones of India; Concept of potential yield; Modern concepts in tillage - zero, minimum and conservation tillage.	**15**
UNIT-II	Optimization of plant population and planting geometry in relation to soil fertility, solar radiation and available moisture regimes; Mitscherlich, Baule and Inverse yield: nitrogen laws; Biotic and abiotic stresses; Concept of ideal plant type; Organic farming, Physiology of grain yield in cereals.	**15**
UNIT-III	Crop growth analysis; Crop modelling in agronomic systems; Precision agriculture; Growth regulators and their role in agriculture; Designer crops; Vermi-technology; Agro biodiversity; Seed priming; Indigenous technological knowledge; Herbicide resistance in weeds; Allelopathy in agriculture; Plant nutrition and disease tolerance in field crops.	**15**
	PRACTICAL	
	NA	

Course Outcomes:

After taking the course, students will be able to:

1. Learn about the mineral nutrition in plants.
2. Equip students with skills and techniques related to plant physiology so that they can design their own experiments.
3. Learn Optimization of plant population and planting geometry in relation to soil fertility,
4. Learn Physiology of grain yield in cereals.

Suggested Books:

1. Gardner, F.P.; Pearce, G.R. and Michell, R.I. Physiology of Crop Plants, Scientific Pub., Jodhpur.
2. Palaniappan, S.P. and Shivarama, K. (1996). Cropping Systems in the Tropics – Principles and Management. New Age International Pub.
3. Fageria, N.K. (1992). Maximising crop yields. Marcel Dekker, New York.
4. Reddy,S.R. (2000). Principles of Agronomy. Kalyani Pub. New Delhi.
5. Redford, J. (1967). Growth Analysis formulae: Their use and abuse. Crop Science. 76:171 - 175.
6. Singh, G.; Kolar, J.S. and Sekhon, H.S.(2002). Recent Advances in Agronomy (Ed). ISA, Publication, New-Delhi.
7. Paroda, R.S. (2003). Sustaining Our Food Security. Konark Publishers Pvt. Ltd., Delhi

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Principles and Practices of Weed Management
SUBJECT CODE: AGRO-5125
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To familiarize the students about the weeds, herbicides and methods of weed control.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Weed–biology, ecology and classification; history, development and classification of herbicides; their properties, mode of action and uses, basis of selectivity of herbicides; herbicide mixtures, adjuvants and safeners.	**10**
UNIT-II	Weed control principles and management practices in important grain crops, oilseeds, pulses, sugar, fibre crops, tuber crops and forage crops; vegetables and orchards; weed control under specific situations viz. intercropping systems, non-cropped areas and dry lands; noxious farm weeds and parasitic weeds and their control.	**08**
UNIT-III	Fate of herbicides in soil; herbicide - pesticides and fertilizer interactions; allelopathic effect; integrated weed management; problem of aquatic weeds particularly water hyacinth, hydrilla and typha grass in Rajasthan and their possible control measures; weed control through bio herbicides and myco- herbicides; herbicide resistance in weeds and crops.	**12**
	PRACTICAL	
	• Identification of common kharif, rabi and perennial weeds of crop fields, road sides, waste lands and irrigation channels; familiarization with trade names, common names, uses, cost and source of availability of herbicides. • Calibration of sprayer and maintenance (before and after use); study of different herbicidal formulations; calculation on herbicidal requirement for field crops and aquatic situation; application of herbicides in field crops. • Control of some noxious weeds by cultural and chemical means; study on weed control efficiency and calculation on weed infestation and weed index; preparation of weed herbarium, methodology for weed control research and precautions in handling or storage of herbicides.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Know the water resources of India. Know the different irrigation projects, soil water plant relationship.
2. Understand the water management crop and cropping systems and management of crops.
3. Understand the plant adaptation to moisture stress condition quality of irrigation water.
4. Understand the effect of excess water on plant growth, drainage requirements of crop, layout and special irritability of lands.

Recommended Books

1. Aldrich RJ & Kramer RJ. (1997). Principles in Weed Management. Panima Publ.
2. Ashton FM & Crafts AS. (1981). Mode of Action of Herbicides. 2nd Ed. Wiley Inter-Science.
3. Gupta O. P. (2007). Weed Management – Principles and Practices. Agrobios.
4. Mandal RC. 1990. Weed, Weedicides and Weed Control - Principles and Practices. Agro-Botanical Publ.
5. Rao V.S. (2000). Principles of Weed Science. Oxford & IBH.
6. Subramanian S, Ali AM & Kumar RJ. (1997). All About Weed Control.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Cropping Systems and Sustainable Agriculture
SUBJECT CODE: AGRO-5126
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

Sr. No	Contents	Contact Hours
THEORY		
UNIT-I	Cropping systems- intercropping and multiple cropping, concepts, needs, indices and assessment; existing cropping systems under irrigated and rainfed situations. Cropping system indices viz., relative spread index and relative yield index.	**15**
UNIT-II	Farming system: integrated farming system, alternate farming system - meaning and scope including specific examples. Recycling and crop residue management. Natural farming - concept and components. Organic farming.	**15**
UNIT-III	Crop diversification – principles, types and needs, Sustainable agriculture - definition, scope and objectives, Natural resources, their characterization and management; Sustainable cropping and farming systems in agriculture in relation to environmental degradation; Research needs on sustainable agriculture.	**15**
PRACTICAL		
	NA	

Course Outcomes:

After taking the course, students will be able to:
1. Important cropping system for sustainable agriculture in India.
2. Students learn sustainable agriculture in relation to tillage, fertilizers, irrigation, weed management and plant protection measures.
3. Students learn Natural farming - concept and components and Organic farming.
4. Students learn Crop diversification – principles, types and needs, Sustainable agriculture

Recommended Books

1. K.N. Singh and R.P. Singh (Eds), (1990). Agronomic Research Towards Sustainable Agriculture, Indian Society of Agronomy, New Delhi
2. Singh, R.P. (1990). Sustainable Agriculture: Issues, Perspectives and Prospects in Semi Arid Tropics. Vol I & II Indian Society of Agronomy, New Delhi
3. Devlin, R.M. and Watham, E.H. (1986). Plant Physiology. CBS Publishers and Distributors, New Delhi.
4. Somani, L.L., Totawat, K.L and Baser, B.L (Ed.) (1992) Proceedings of National Seminar on Natural Farming, NSMP Publication, Rajasthan College of Agriculture, Udaipur
5. Panda S.C. (2006). Cropping and Farming Systems, Agrobios (India)

Program Name: M. Sc Agriculture
Program Code: AG 403

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Field Plot Techniques
SUBJECT CODE: AGRO-5127
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
1	0	0	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Conduct of the experiment, actual layout of field experiments and precautions during sowing. Sampling- soil and plants. Recording biometrical observations.	**15**
UNIT-II	Sources of error in the field experiments and methods of reducing it. Optimum plot size and number of replications. Selection of experimental designs- RCBD, factorial RCBD, split plot, double split plot and interaction effects.	**15**
UNIT-III	Missing plots and analysis of variance results. Compilation, presentation and interpretation of the data.	**15**

Course Outcomes:

After taking the course, students will be able to:

1. To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

2. To acquaint the students about Sources of error in the field experiments and methods of reducing it.

3. To acquaint the students about Optimum plot size and number of replications. Selection of experimental designs- RCBD, factorial RCBD, split plot, double split plot and interaction effects.

4. Get an idea about Compilation, presentation and interpretation of the data.

BOOKS

1. Rao, G. Nageshwara (2007) Statistics for Agricultural Sciences. Second Edition. BS Publications, Hyderabad.
2. Gomez, Kwanchai A. and Gomez Arturo A. (1984) Statistical Procedures for Agricultural Research. Second Edition. A Wiley-Interscience Publication. New York.
3. Gupta, V. K., Rajender Parsad, Lal Mohan Bhar, Baidya Nath Mandal (2016) Statistical Analysis of Agricultural Experiments. Part – I : Single Factor Experiments. ICAR-Indian Agricultural Statistics Research Institute, Pusa, New Delhi.
4. Panse, V. G. and Sukhatme, P. K. (1984) Statistical Analysis for Agricultural Workers. ICAR New Delhi Publication.
5. Sheoran, O.P., Tonk, D.S., Kaushik, L.S., Hasija, R.C. and Pannu, R.S. (1998) Statistical Software Package for Agriculture Research Workers. Department of Mathmatics and Statistics, CCS HAU, Hisar.

SUBJECT TITLE: Soil Fertility and Fertilizer Use
SUBJECT CODE: SOIL-5214
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To impart knowledge about soil fertility and its control, and to understand the role of fertilizers and manures in supplying nutrients to plants so as to achieve high fertilizer use efficiency.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms, soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation-types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency, soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils.	**15**
UNIT-II	Factors affecting phosphorus availability in soils; phosphatic fertilizers-behaviour in soils and management under field conditions, potassium-forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions, sulphur - source, forms, fertilizers and their behaviour in soils; calcium and magnesium– factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers, micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants.	**15**
UNIT-III	Role of chelates in nutrient availability, common soil test methods for fertilizer recommendations; quantity– intensity relationships; soil test crop response correlations and response functions, fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site- specific nutrient management; plant need based nutrient management; integrated nutrient management, soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.	**15**
	PRACTICAL	
	Chemical analysis of soil for total N,P&K and available nutrients (N, P, K, S, Cu, Fe, Mn ,Zn, Mo. B), analysis of plants for essential elements (N, P, K, S, Cu, Fe, Mn, Zn, Mo, B)	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Know the soil fertility and productivity. know soil composition and deficiency and toxicity symptoms of major and micronutrients.
2. Understand transformations and dynamic of major plant nutrients, different types of fertilizer and their application.
3. Understand fertilizer use efficiency, nutrient interaction and integrated plant nutrient supply system.
4. To know about the vermicompost, biofertilizers and sustainable agriculture.

Suggested Books:

1. Brady NC and Weil RR. (2002). The Nature and Properties of Soils. 13th Ed. Pearson Edu.
2. Kabata-Pendias A and Pendias H. (1992). Trace Elements in Soils and Plants. CRC Press.
3. Kannaiyan S, Kumar K and Govindarajan K. (2004). BiofertilizersTechnology. Scientific Publ.
4. Leigh J.G. (2002). Nitrogen Fixation at the Millennium. Elsevier.
5. Mengel K and Kirkby EA. (1982). Principles of Plant Nutrition. International Potash Institute, Switzerland.
6. Mortvedt J.J; Shuman L.M; Cox FR and Welch RM. (1991). Micronutrients in Agriculture. 2nd Ed. SSSA, Madison.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Fertilizer Technology
SUBJECT CODE: SOIL-5217
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

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

Sr. No	Contents	Contact Hours
THEORY		
UNIT-I	Fertilizers – production, consumption and future projections with regard to nutrient use in the country and respective states	**10**
UNIT-II	Fertilizer control order, manufacturing processes for different ferti using various raw materials, characteristics and nutrient contents, r developments in secondary and micronutrient fertilizers and their q control as per fertilizer control order.	**10**
UNIT-III	New and emerging issues in fertilizer technology – production and u slow and controlled release fertilizers, supergranules fertilizers fertilizers for specific crops/situations.	**10**
PRACTICAL		
	NA	

Course Outcomes:

After taking the course, students will be able to:
1. Use reactions and unit operations steps in manufacturing of various fertilizers
2. Know about Fertilizers – production, consumption and future projections with regard to nutrient use in the country and respective states
3. Learn about manufacturing processes for different fertilizers using various raw materials,
4. Know about production and use of slow and controlled release fertilizers.

Recommended Books

1. Brady NC and Weil RR. (2002). The Nature and Properties of Soils. Pearson Edu.
2. Kanwar JS. (Ed.). (1976). Soil Fertility: Theory and Practice. ICAR.
3. Olson RA, Army TS, Hanway JJ and Kilmer VJ. (1971). Fertilizer Technologyand Use. 2nd Ed. Soil Sci. Soc. Am. Madison.
4. Prasad R and Power JF. Soil Fertility Management for SustainableAgriculture. CRC Press.
5. Tisdale SL, Nelson SL, Beaton JD & Havlin JL. (1999). Soil Fertility and Fertilizers. McMillan.
6. Panda S.C. (2006). Cropping and Farming Systems, Agrobios (India)

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

THIRD SEMESTER

M.Sc. Agriculture (Agronomy)

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
Core Courses											
AGRO-5217	Agronomy of Major Cereals and Pulses	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Ability Enhancement Compulsory Courses											
ASTA-5211	Statistical Methods for Agricultural Research	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Ability Enhancement Compulsory Courses											
APGS-5211	Technical Writing, Communication Skills, Library and Information Services	1	0	0	1	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SOIL-5218	Analytical Techniques and Instrumental Methods in Soil and Plant Analysis	0	0	2	1	---	60	----	40	100	03
AGRO-5091	Master's Seminar	1	0	0	1	00	---	00	100	100	00
AGRO-5099	Master's Research	0	0	7	7	---	---	---	---	---	---
Total		**8**	**0**	**15**	**19**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-III

SEMESTER III

SUBJECT TITLE: Agronomy of Major Cereals and Pulses
SUBJECT CODE: AGRO-5217
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To teach the crop husbandry of Major Cereals and Pulses

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Origin and history, area and production, classification.	**16**
UNIT-II	Improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components.	**15**
UNIT-III	Handling and processing of the produce for maximum production of rice, wheat, maize, barley, sorghum, pearl millet, chickpea and pigeon pea.	**14**
	PRACTICAL	
	• Phenological studies at different growth stages of crops, different methods of raising nursery including dapog in rice; estimation of crop yields on the basis of yield attributes; calculation of fertilizer requirements and their application at different stages of growth on the basis of soil test values. • Computation of cost of cultivation of various crops, planning and layout of field experiments, formulation of cropping scheme for various farm sizes, calculation of cropping and rotation intensities, visit of field experiments for cultural, fertilizer, weed control and water management aspects. • Working out indices of intercropping systems – L.E.R. aggressivity, relative crowding coefficient and monetary yield advantage, ATER; determination of physiological maturity in different crops; working out of harvest index in various crops; computation of growth analysis indices. Study of root nodules and seed treatment with bio-fertilizers in pulses, Estimation of protein in pulses.	**30**

Course Outcomes:

After taking the course, students will be able to:
1. Concept of major field crops (including cereals, pulses, oilseeds and fiber crops).
2. Knowledge of farm yard manures soil requirements for field crops including fertilizers, manures.
3. Basics if origin, history, distribution, adaptations of different crops according to the environment.
4. In-depth knowledge of sustainable agriculture and cropping and farming systems. In-depth knowledge of production technology.

Suggested Books

1. Das NR. (2007). Introduction to Crops of India. Scientific Publ.
2. Hunsigi G and Krishna KR. (1998). Science of Field Crop Production. Oxford &IBH.
3. Kumar R. and Singh NP. (2003). Maize Production in India: Golden Grain in Transition. IARI, New Delhi.
4. Pal M, Deka J and Rai R.K. (1996). Fundamentals of Cereal Crop Production. Tata McGrawHill.
5. Prasad, R. (2002). Text Book of Field Crop Production. ICAR.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Statistical Methods for Agricultural Research
SUBJECT CODE: ASTA-5211
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To acquaint with basic statistical methods and their application in agricultural research

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error.	**15**
UNIT-II	Simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests.	**15**
UNIT-III	Confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.	**15**
	PRACTICAL	
	Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. The students can understand the statistical concepts applied in agricultural research.
2. Can apply statistical tools in design of experiments.
3. Can acquire skills in analyzing statistical data efficiently.
4. Can acquire skills on Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Suggested Books:

1. Anderson TW. (1958). An Introduction to Multivariate Statistical Analysis. John Wiley.
2. Dillon WR & Goldstein M. (1984). Multivariate Analysis - Methods and 15 Applications. John Wiley.
3. Goon AM, Gupta MK & Dasgupta B. (1977). An Outline of Statistical Theory. Vol. I. The World Press.
4. AM, Gupta MK and Dasgupta B. (1983). Fundamentals of Statistics. Vol. I. The World Press. Hoel PG. (1971). Introduction to Mathematical Statistics. John Wiley.
5. Hogg RV & Craig TT. (1978). Introduction to Mathematical Statistics. Macmillan.
6. Gupta B.N.(2016). Fundamentals of Statistics, SBPD Publications
7. Learning Statistics: http://freestatistics.altervista.org/en/learning.php. Electronic Statistics Text Book:

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Technical Writing, Communication Skills, Library and Information Services
SUBJECT CODE: APGS 5211
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
1	0	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart the knowledge of technical writing and use of library resources and books

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Technical Writing-Various forms of technical writing-theses, technical papers, reviews, electronic communication etc; qualities of technical writing; parts of research communications- title page, content page, authorship, preface, introduction, review of literature, materials and methods, experimental results	**08**
UNIT-II	Documentation; photographs and drawings with suitable captions; pagination; citations; writing of abstracts; précis; synopsis; editing and proof reading. Communication Skills-defining communication; types of communication- verbal and non-verbal; assertive communication; assertive 445 communication; using language for effective communication	**04**
UNIT-III	Techniques of dyadic communication- message pacing and message chunking, self disclosure, mirroring, expressing conversational intent; paraphrasing; vocabulary building- word roots, prefixes, Greek and Latin roots.	**03**
	PRACTICAL	
	Editing and Proof reading technical articles; using language tools for effective writing; listening to audio-video conversations aimed at testing the comprehension of the students; oral presentations on a given topic related to agriculture; evaluation of body language and communication skills based on group discussions and interviews; role plays and pronunciation exercises; using eye contact and visual clues for effective listening skills; word stress application and voice modulation; soft skills; rhetoric skills; self-assessment exercises. Introduction to Library and its services; Five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information-primary, secondary and tertiary; current awareness and SDI services; tracing information from reference sources; library survey; preparation of bibliography; use of Online Public Access Catalogue; use of CD-ROM databases and other computerized library services, CeRA, J-Gate; use of Internet including search engines and its resources; e-resources and access methods.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Learn that what the various forms of scientific writings are.
2. Learn how to write the various parts of thesis, research communications. Learn how to do writing of abstracts, summaries and what are citations etc.
3. Learn research communications, illustrations, photograph, and drawings.
4. Learn pagination, scientific write ups, editing and proof reading, and writing of review article.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Analytical Techniques and Instrumental Methods in Soil and Plant Analysis
SUBJECT CODE: Soils 5218
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.

Sr. No	Contents	Contact Hours
	PRACTICAL	
	Soil, water and plant sampling techniques, their processing and handling. Estimation of soil texture, electric conductivity, pH and organic carbon.	**30**
	Analysis of soil and plant samples for Nitrogen, Phosphorus, Potassium, Calcium, Magnesium , Sulphur, Zink, Iron, Manganese, Boron and Molybdenum.	
	Analysis of plant materials by digesting plant material by wet and dry ashing and soil by wet digestion methods	

Course Outcomes:

After taking the course, students will be able to:

1. To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.
2. To impart knowledge on Soil, water and plant sampling techniques, their processing and handling.
3. Learn about Analysis of soil and plant samples for nutrients.
4. Analysis of plant materials by digesting plant material by wet and dry ashing and soil by wet digestion methods.

Suggested Books:

1. Dhyan Singh, PK Chhonkar, and DS Dwivedi. Manual on soil, plant and water analysis, Westville Publishing House
2. M.L. Jackson. Soil Chemical Analysis, Prentice Hall Inc.
3. Willard, H.H., Merritt, L.L. Jr.; Dean, J.A.; Settle, F.A. Jr.Instrumental methods of analysis,7th Edition, Wadsworth Publishing Company
4. A. Klute. Methods of soil analysis, Part 1, Physical and Mineralogical Methods (2nd edition), 1986, American Society of Agronomy, Agronomy Monographs 9(1), Madison, Wisconsin
5. C.S. Piper. Soil and plant analysis: a laboratory manual of methods for the examination of soils and the determination of the inorganic constituents of plants, Bombay: Hans. (1966)

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

FOURTH SEMESTER

M.Sc. Agriculture (Agronomy)

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
AbilityEnhancementCompulsoryCourses											
AIPR-5221	Intellectual Property Rights and its Management	2	0	0	2	16	---	24	60	100	03
SkillEnhancementCompulsoryCourses											
AGRO-5099	Master's Research	0	0	16	16	---	---	---	---	---	---
Total		**2**	**0**	**16**	**18**						

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

Total credit hours for the degree programme = 48+26NC

Semester Wise Summary of the program

S.no.	Semester	No. of ContactHours	Marks	Credits
1.	I	23	1000	18
2.	II	18+3NC	800	16+3NC
3.	III	16+7NC	800	12+7NC
4.	IV	2+16NC	100	2+16NC
	Total	59+26NC	2700	48+26NC

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-IV

SEMESTER IV

SUBJECT TITLE: Intellectual Property Rights and its Management
SUBJECT CODE: AIPR-5221
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs	**05**
UNIT-II	Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection	**05**
UNIT-III	Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.	**06**
	PRACTICAL	
	NA	

Course Outcomes:

After taking the course, students will be able to:

1. Students will be aware of Intellectual Property Rights for ensuring rights for their products.
2. Students will be aware of Indian Legislations for the protection of various types of Intellectual Properties.
3. Students will be aware of Fundamentals of patents, copyrights, geographical indications.
4. Students will be aware of National Biodiversity protection initiatives; Convention on Biological Diversity;

Suggested Books:

1. Erbisch FH and Maredia K.(1998). Intellectual Property Rights in Agricultural Biotechnology. CABI.
2. Ganguli P. (2001). Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
3. Ministry of Agriculture, Government of India. (2004). State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
4. Rothschild M and Scott N. (Ed.). (2003). Intellectual Property Rights in Animal Breeding and Genetics. CABI.
5. Saha R. (Ed.). (2006). Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
6. The Indian Acts - Patents Act, (1970) and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Programme Name: M. Sc Horticulture

FIRST SEMESTER

Programme Code: AG 403

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
Core Courses											
HORT-5111	Tropical and Dry land Horticulture	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5112	Sub-Tropical and Temperate Fruit Production	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5113	Production Technology of Warm Season Vegetable Crops	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
APPP-5111	Principles of Plant Physiology	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SOIL-5111	Management of Problematic Soils and Water	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Total		**13**	**0**	**10**	**18**						

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid Term Exam

ETE End Term Exam

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-I

Detailed Syllabus

SUBJECT TITLE: Tropical and Dry land Horticulture
SUBJECT CODE: HORT-5111

SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

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

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	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 production.of tropical and dry land fruits.	**15**
UNIT-II	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.of tropical and dry land fruits	**15**
UNIT-III	Industrial and export potential, Agri. Export Zones (AEZ) and industrial supports. Crops Mango and Banana, Papaya, Coconut and Cashew nut, Sapota and Jackfruit, Pineapple and Annonas, Aonla, Pomegranate, Phalsa and Ber, minor fruits of tropics (Mahua, Lasoda, Mulberry, Tamarind and Chironji).	**15**
	PRACTICAL	
	• Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analysis of quality attributes. • Practices of important agro-techniques, visit to tropical and arid zone orchards. • Project preparation for establishing commercial orchards.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Impart basic knowledge about the importance and management of tropical and dry land Horticulture crops grown in India.
2. Brief knowledge of commercial varieties of regional, national and international importance eco-physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping system, root zone and canopy management, nutrient management, water management, fertigation.
3. 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, harvest, grading, packing.
4. Storage and ripening techniques; industrial and export potential, Agri. Export Zones (AEZ) and industrial support.

Suggested Books:

1. Bose, TK, Mitra, SK & Rathore, DS. (Eds.). 1988. Temperate Fruits - Horticulture. Allied Publ.
2. Bose, T.K, Mitra, S.K & Sanyal, D. 2001. (Eds.). Fruits -Tropical and Subtropical. Naya Udyog.
3. Chadha, K.L & Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. II- IV. Malhotra Publ. House.
4. Nakasone, H.Y & Paul, R.E. 1998. Tropical Fruits. CABI. Peter, K.V. 2008. (Ed.). Basics of Horticulture. New India Publ. Agency.
5. Pradeep Kumar T, Suma B, Jyothi Bhaskar & Satheesan, K.N. 2008. Management of Horticultural Crops. Parts I, II. New India Publ. Agency.
6. Singh HP, Negi JP& Samuel JC. (Eds.). 2002. Approaches for Sustainable Development of Horticulture. National Horticultural Board.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Sub-Tropical and Temperate Fruit Production
SUBJECT CODE: HORT-5112
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart basic knowledge about the importance and management of subtropical and temperate fruits grown in India.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bio regulation, abiotic factors limiting production. limiting production.of sub-tropical and temperate fruits	**18**
UNIT-II	Physiology of flowering, fruit set and development, abiotic factors limiting production, physiological disorders-causes and remedies, quality improvement of limiting production .of sub-tropical and temperate fruits by management practices.	**12**
UNIT-III	Maturity indices, harvesting, grading, packing, pre-cooling, storage, transportation and ripening techniques; industrial and export potential, Agri Export Zones (AEZ) and industrial support. Crops- Apple, pear, quince, Plums, peach, apricot, cherries, Litchi, loquat, kiwifruit, strawberry Nuts- walnut, almond, pistachio, Grapes, Guava, Citrus and Custard apple, Minor fruits-carambola, bael, wood apple, fig, jamun, rambutan, ker, pilu.	**15**
	PRACTICAL	
	• Identification of important fruit plants and its available cultivars, observations on growth and development. • Practices in growth regulation, malady diagnosis, an analysis of quality attributes. • Visit to tropical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. The students will know about the package and practices of subtropical and temperate fruit crops along with the knowledge of diseases, pests and physiological disorders, mineral deficiency problems maturity indices for harvesting the crops and economics of the subtropical and temperate fruit crops.
2. Development innovative agro- techniques to enhance the production and productivity of subtropical and temperate fruit crops.
3. After gaining experience, they will increase farmers' income through adopting hi-tech horticulture
4. Students will able to understand the proper havesting techniques and nutrition management of the fruits crops

Suggested Books

1. Bose T.K, Mitra S.K & Sanyal D. (Ed.). 2002. Fruits of India —Tropical and Sub-tropical. 3 rd Ed. Vols. I, II. Naya Udyog.
2. Chadha K.L & Pareek O.P. 1996. (Eds.). Advances in Horticulture. Vol. I. Malhotra Publ. House.
3. Janick J & Moore J.N. 1996. Fruit Breeding. Vols.I-III. John Wiley & Sons.
4. Nijjar GS. 1977. (Eds.). Fruit Breeding in India. Oxford & IBH.
5. Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Production Technology of Warm Season Vegetable Crops
SUBJECT CODE: HORT-5113
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To teach production technology of warm season vegetables.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, Tomato, eggplant, hot and sweet peppers, Okra, beans, cowpea and clusterbean, Cucurbitaceous crops, Colocasia and sweet potato, Green leafy warm season vegetables.	**15**
UNIT-II	Nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, Tomato, eggplant, hot and sweet peppers, Okra, beans, cowpea and clusterbean, Cucurbitaceous crops, Colocasia and sweet potato, Green leafy warm season vegetables.	**15**
UNIT-III	Harvesting, postharvest management, plant protection measures, economics of crop production and seed production of: Tomato, eggplant, hot and sweet peppers, Okra, beans, cowpea and clusterbean, Cucurbitaceous crops, Colocasia and sweet potato, Green leafy warm season vegetables.	**15**
	PRACTICAL	
	Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics; study of physiological disorders and deficiency of mineral elements. Preparation of cropping schemes for commercial farms; experiments to demonstrate the role of mineral elements, physiological disorders; plant growth substances and herbicides. Seed extraction techniques; identification of important pests and diseases and their control; maturity standards; economics of warm season vegetable crops.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Teach production technology of warm season vegetables.
2. Introduction to warm season vegetables, their botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods.
3. Knowledge of seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting.
4. How to handle post harvest management, plant protection measures, economics of crop production and seed production of warm season vegetables.

Suggested Books:

1. Bose TK & Som MG. (Eds.). 1986. Vegetable Crops in India. Naya Prokash.
2. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG.2003. Vegetable Crops. Vols. I-III. Naya Udyog.
3. Chadha KL. (Ed.).2002. Hand Book of Horticulture. ICAR. Chauhan D.V.S. (Ed.). 1986. Vegetable Production in India. Ram Prasad & Sons.
4. Decoteau DR. 2000. Vegetable Crops. Prentice Hall.
5. Fageria MS, Choudhary BR & Dhaka RS.2000.Vegetable Crops: Production Technology.vol. II. Kalyani.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Principles of Plant Physiology
SUBJECT CODE: APPP-5111
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: The course aims at imparting knowledge about various aspects of plant physiology of plant growth regulator on growth and development of plant.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Definition and classification of plant growth regulators- Hormones, endogenous growth substances and synthetic chemicals, Site of synthesis, biosynthetic pathways and metabolism and the influence on plant growth development of individual group of hormones- Auxins, Gibberlins, cytokinins, Abscisic acid and Ethylene	**10**
UNIT-II	Endogenous growth regulating substances other than hormones; Brassinosteroids, tricontanol; Phenols – polyamines, jasmonates, concept of death hormone	**10**
UNIT-III	Synthetic growth regulators- Classification, their effect on plant growth and development; Practical utility in agriculture and horticulture.	**10**
	PRACTICAL	
	Quantification of Hormones- Principles of bioassays; Extraction of hormones from plant tissue; Auxins- bioassays- auxins effect on rooting of cuttings, abscission, apical dominance, Gibberellins- bioassays-GA effect on germination of dormant seeds, cytokinin- bioassays- estimation using immunoassay technique cytokinin effect on apical dominance and senescence, ABA bioassays estimation using immunoassay technique; ABA effect on stomatal movement, Ethylene bioassays, estimation using physico chemical techniques- effect on breaking dormancy in sunflower and groundnut.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Learn about the mineral nutrition in plants.
2. Equip students with skills and techniques related to plant physiology so that they can design their own experiments.
3. Learn about Endogenous growth regulating substances.
4. Learn about Synthetic growth regulators and quantification of hormones.

Recommended Books

1. Hopkins WG and Huner NPA. (2004). Introduction to Plant Physiology. John Wiley & Sons.
2. Salisbury FB and Ross C. (1992). Plant Physiology. 4th Ed. Wadsworth Publ.
3. Taiz L and Zeiger E. (2006). Plant Physiology. 4th Ed. Sinauer Associates.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Management of Problematic Soils and Water
SUBJECT CODE: SOIL-5111
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils in relation to using soils as a medium for plant growth.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Area, distribution, origin and basic concepts of problematic soils. Morphological features and characterization of salt-affected soils. Management of salt- affected soils. Salt tolerance of crops - mechanism and ratings.	**12**
UNIT-II	Monitoring of soil salinity in the field. Management principles for sandy, clayey, red lateritic and dry land soils. Acid soils - nature, sources and management. Effect on plant growth. Lime requirement of acid soils. .	**10**
UNIT-III	Biological sickness of soils and its management. Quality of irrigation water, management of brackish water. Salt balance under irrigation. Characterization of brackish waters, area and extent. Agronomic practices in relation to problematic soils. Cropping pattern for utilizing poor quality ground waters.	**10**
	PRACTICAL	
	Characterization of acid, acid sulfate, salt- affected and calcareous soils. Determination of cations (Na+, K+, Ca+, and Mg++) in ground water and soil samples. Determination of anions (CI^-, SO_4^{2-}, CO_3^{2-} and HCO_3^-) in ground waters and soil samples. Lime and gypsum requirement of acid and sodic soil..	**30**

Course Outcomes:

After taking the course, students will be able to:

1. The students get knowledge about different kind of problem soil in India and their characteristics.
2. The students will understand how to control or improve the soil fertility.
3. The students gain practical knowledge of laboratory to test the problem soil.
4. The students gain practical knowledge of Characterization of brackish waters, and agronomic practices in relation to problematic soils.

Recommended Books

1. Bear F.E. (1964).. Chemistry of the Soil. Oxford & IBH.
2. Jurinak J.J. (1978). Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
3. Cirsan Paul, J. (1985). Principles of remote sensing. Longman, New York.
4. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SECOND SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
Core Courses											
HORT-5124	Seed Production Technology of Vegetable Crops	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5125	Postharvest Technology for Fruit Crops	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5126	Landscaping and Ornamental Gardening	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SOIL-5214	Soil Fertility and Fertilizer Use	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SOIL-5217	Fertilizer Technology	2	0	0	2	16	---	24	60	100	03
Skill Enhancement Compulsory Courses											
HORT-5099	Master's Research	0	0	3	3	---	---	---	---	---	---
Total		**11**	**0**	**11**	**18**						

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid Term Exam

ETE End Term Exam

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-II

SEMESTER II

SUBJECT TITLE: Seed Production Technology of Vegetable Crops
SUBJECT CODE: HORT-5124
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To educate students about principles and methods of quality seed and planting material production in vegetable crops.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India. Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production.	**10**
UNIT-II	Floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production. Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards.	**08**
UNIT-III	Seed act and law enforcement, plant quarantine and quality control. Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology. Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra.	**12**
	PRACTICAL	
	Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing; testing, releasing and notification procedures of varieties; floral biology. Rouging of off-type; methods of hybrid seed production in important vegetable and spice crops; seed extraction techniques; handling of seed processing and seed testing equipments. Seed sampling; testing of vegetable seeds for seed purity, germination, vigour and health; visit to seed processing units, seed testing laboratory and seed production farms.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Educate principles and methods of quality seed and planting material production in vegetable crops.
2. Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India.
3. Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production
4. Knowledge of floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production.

Suggested Books:

1. Agrawal PK & Dadlani M. (Eds.). 1992. Techniques in Seed Science and Technology. South Asian Publ.
2. Agrawal RL. (Ed.). 1997. Seed Technology. Oxford & IBH.
3. Bendell PE. (Ed.). 1998. Seed Science and Technology: Indian Forestry Species. Allied Publ.
4. Fageria MS, Arya PS & Choudhary AK. 2000. Vegetable Crops: Breeding and Seed Production. vol. I. Kalyani.
5. George RAT. 1999. Vegetable Seed Production. 2nd Ed. CABI.
6. Kumar JC & Dhaliwal MS. 1990. Techniques of Developing Hybrids in Vegetable Crops. Agro Botanical Publ.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: **Postharvest Technology for Fruit Crops**
SUBJECT CODE: HORT-5125
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To facilitate deeper understanding on principles and practices of post harvest management of fruit crops.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration. Physiology and biochemistry of fruit ripening.	**10**
UNIT-II	Ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling. Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, physical injuries and disorders.	**10**
UNIT-III	Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juice, beverages, pickles, jam, jellies, sauces and ketchup, candies, preserve. Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards.	**10**
	PRACTICAL	
	• Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables. • Estimation of transpiration, respiration rate, ethylene release and study of shelf life extension in cut flower using chemicals, estimation of quality characteristics in stored fruits and vegetables. • Practices of preservation by salt, sugar, vinegar and chemical preservatives, cold chain management -visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Facilitate deeper understanding on principles and methods of postharvest management of Fruit crops.
2. Maturity indices, harvesting practices for specific market requirements, influence of pre and post-harvest practices, respiration, transpirational loss.
3. Physiology and biochemical change during ripening, senescence, ethylene evolution and ethylene management, factors leading to post-harvest loss and its control, pre- cooling.
4. Study of post-harvest loss and their control.

Suggested Books:

1. Bhutani R.C. 2003. Fruit and Vegetable Preservation. Biotech Books.
2. Chadha K.L & Pareek O.P. (Eds.). 1996 Advances in Horticulture. Vol. IV. Malhotra Publ. House.
3. Haid N.F & Salunkhe S.K. 1997. PostHarvest Physiology and Handling of Fruits and Vegetables. Grenada Publ.
4. Mitra S.K. 1997. Post-Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI.
5. Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.
6. Sudheer K.P & Indira V. 2007. Post-Harvest Technology of Horticultural Crops. New India Publ. Agency.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Landscaping and Ornamental Gardening
SUBJECT CODE: HORT-5126
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: Familiarization with principles and practices of landscaping and ornamental gardening.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Landscape designs, types of gardens, English, Mughal, Japanese, Persian, Spanish, Italian, Buddha garden; Styles of garden, formal, informal and free style gardens. Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporates.	**08**
UNIT-II	Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.	**15**
UNIT-III	Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves. Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.	**12**
	PRACTICAL	
	• Identification of ornamental plants, practices in preparing designs for home gardens, industrial gardens, institutional gardens, corporates, avenue planting. • Practices in planning and planting of special types of gardens, burlapping, lawn making, planting herbaceous and shrubbery borders. • Project preparation on landscaping for different situations, visit to parks and botanical gardens, case study on commercial landscape gardens.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Familiarization with principles and practices of landscaping and ornamental gardening.
2. Landscape designs, its principles and practices of landscaping and ornamentals.
3. Knowledge of Gardening structure.
4. Styles of garden, types of gardens: English, Mughal, Japanese, Persian, Spanish, Italian, Vanams, Buddha garden, Popular gardens of India.

Suggested Books:

1. Bose T.K, Maiti R.G, Dhua R.S & Das P.1999. Floriculture and Landscaping. Naya Prakash.
2. Lauria A &Yictor H.R. 2001. Floriculture-Fundamentals and Practices Agrobios.
3. Nambisan K.M.P.1992. Design Elements of Landscape Gardening. Oxford & IBH.
4. Randhawa G.S & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.
5. Sabina G.T & Peter K.Y. 2008. Ornamental Plants for Gardens. New India Publ. Agency.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Soil Fertility and Fertilizer Use
SUBJECT CODE: SOIL-5214
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To impart knowledge about soil fertility and its control, and to understand the role of fertilizers and manures in supplying nutrients to plants so as to achieve high fertilizer use efficiency.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms, soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation-types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency, soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils.	**15**
UNIT-II	Factors affecting phosphorus availability in soils; phosphatic fertilizers-behaviour in soils and management under field conditions, potassium-forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions, sulphur - source, forms, fertilizers and their behaviour in soils; calcium and magnesium– factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers, micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants.	**15**
UNIT-III	Role of chelates in nutrient availability, common soil test methods for fertilizer recommendations; quantity– intensity relationships; soil test crop response correlations and response functions, fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site- specific nutrient management; plant need based nutrient management; integrated nutrient management, soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.	**15**
	PRACTICAL	
	Chemical analysis of soil for total N,P&K and available nutrients (N, P, K, S, Cu, Fe, Mn ,Zn, Mo. B), analysis of plants for	**30**

	essential elements (N, P, K, S, Cu, Fe, Mn, Zn, Mo, B)	

Course Outcomes:

After taking the course, students will be able to:

1. Know the soil fertility and productivity. know soil composition and deficiency and toxicity symptoms of major and micronutrients.
2. Understand transformations and dynamic of major plant nutrients, different types of fertilizer and their application.
3. Understand fertilizer use efficiency, nutrient interaction and integrated plant nutrient supply system.
4. To know about the vermicompost, biofertilizers and sustainable agriculture.

Suggested Books:

1. Brady NC and Weil RR. (2002). The Nature and Properties of Soils. 13th Ed. Pearson Edu.
2. Kabata-Pendias A and Pendias H. (1992). Trace Elements in Soils and Plants. CRC Press.
3. Kannaiyan S, Kumar K and Govindarajan K. (2004). BiofertilizersTechnology. Scientific Publ.
4. Leigh J.G. (2002). Nitrogen Fixation at the Millennium. Elsevier.
5. Mengel K and Kirkby EA. (1982). Principles of Plant Nutrition. International Potash Institute, Switzerland.
6. Mortvedt J.J; Shuman L.M; Cox FR and Welch RM. (1991). Micronutrients in Agriculture. 2nd Ed. SSSA, Madison.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Fertilizer Technology
SUBJECT CODE: SOIL-5217
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

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

Sr. No	Contents	Contact Hours
THEORY		
UNIT-I	Fertilizers – production, consumption and future projections with regard to nutrient use in the country and respective states	**10**
UNIT-II	Fertilizer control order, manufacturing processes for different ferti using various raw materials, characteristics and nutrient contents, r developments in secondary and micronutrient fertilizers and quality control as per fertilizer control order.	**10**
UNIT-III	New and emerging issues in fertilizer technology – production an of slow and controlled release fertilizers, supergranules fertilizer fertilizers for specific crops/situations.	**10**
PRACTICAL		
	NA	

Course Outcomes:

After taking the course, students will be able to:

1. Use reactions and unit operations steps in manufacturing of various fertilizers
2. Know about Fertilizers – production, consumption and future projections with regard to nutrient use in the country and respective states
3. Learn about manufacturing processes for different fertilizers using various raw materials,
4. Know about production and use of slow and controlled release fertilizers.

Recommended Books

1. Brady NC and Weil RR. (2002). The Nature and Properties of Soils. Pearson Edu.
2. Kanwar JS. (Ed.). (1976). Soil Fertility: Theory and Practice. ICAR.
3. Olson RA, Army TS, Hanway JJ and Kilmer VJ. (1971). Fertilizer Technologyand Use. 2nd Ed. Soil Sci. Soc. Am. Madison.
4. Prasad R and Power JF. Soil Fertility Management for SustainableAgriculture. CRC Press.
5. Tisdale SL, Nelson SL, Beaton JD & Havlin JL. (1999). Soil Fertility and Fertilizers. McMillan.
6. Panda S.C. (2006). Cropping and Farming Systems, Agrobios (India)

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

THIRD SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
Core Courses											
HORT-5217	Production Technology of Loose Flowers	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AbilityEnhancementCompulsoryCourses											
ASTA-5211	Statistical Methods for Agricultural Research	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SkillEnhancementCompulsoryCourses											
APGS-5211	Technical Writing, Communication Skills, Library and Information Services	1	0	0	1	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5091	Master's Seminar	1	0	0	1	00	---	00	100	100	00
HORT-5099	Master's Research	0	0	7	7	---	---	---	---	---	---
Total		**8**	**0**	**13**	**19**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-III

SEMESTER III

SUBJECT TITLE: Production Technology of Loose Flowers
SUBJECT CODE: HORT-5217
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To equip students with the knowledge of production techniques and management of loose flowers grown in India.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Scope of loose flower trade, Significance in the domestic market export, varietal wealth and diversity, propagation, sexual and asexual propagation methods, propagation in mist chambers, nursery management, pro -tray nursery under shadenets, transplanting techniques.	**15**
UNIT-II	Soil and climate requirements, field preparation, systems of planting, precision farming techniques. Water and nutrient management, weed management, training and pruning, pinching and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM. Flower forcing and year round flowering, production for special occasions through physiological interventions, chemical regulation.	**15**
UNIT-III	Harvest indices, harvesting techniques, post-harvest handling and grading, pre-cooling, packing and storage, value addition, concrete and essential oil extraction, trasportation and marketing, export potential, institutional support, Agri Export Zones. Crops: Jasmine, scented rose,chrysanthemum, marigold, tuberose, crossandra, nerium, hibiscus, barleria, gomphrena, gaillardia, non-traditional flowers (Nyctanthes, Tabernaemontana, ixora, lotus, lilies, tecoma, champaka, pandanus).	**15**
	PRACTICAL	
	• Botanical description of species and varieties, propagation techniques, mist chamber operation, training and pruning techniques. • Practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking. • Harvesting techniques, post-harvest handling, storage and cold chain, project preparation for regionally important commercial loose flowers, visits to fields, essential oil extraction units and markets.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. The student will have knowledge on advanced production technologies in growing flower crops.
2. The students will be able to diagnose production problems in loose flowers.
3. The students will become capable of managing a open field floriculture unit from planting to harvest.
4. Student knows how to handle the loose flower techniques to implant from raising to harvest the crop.

Suggested Books:

1. Arora J.S. 2006. Introductory Ornamental Horticulture. Kalyani.
2. Bhattacharjee S.K. 2006. Advances in Ornamental Horticulture. vols. I-VI. Pointer Publ.
3. Bose T.K, Maiti R. G, Dhua R.S & Das P.1999. Floriculture and Landscaping.
4. Naya Prokash. Chadha K.L & Chaudhury B.1992. Ornamental Horticulture in India. ICAR.
5. Chadha K.L. 1995. Advances in Horticulture. vol. XII. Malhotra Publ. House.
6. Lauria A & Ries V.H. 2001. Floriculture-Fundamentals and Practices. Agrobios.
7. Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Statistical Methods for Agricultural Research
SUBJECT CODE: ASTA-5211
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To acquaint with basic statistical methods and their application in agricultural research

Sr. No	Contents	Contact Hours
THEORY		
UNIT-I	Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error.	**15**
UNIT-II	Simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests.	**15**
UNIT-III	Confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.	**15**
PRACTICAL		
	Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. The students can understand the statistical concepts applied in agricultural research.
2. Can apply statistical tools in design of experiments.
3. Can acquire skills in analyzing statistical data efficiently.
4. Can acquire skills on Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Suggested Books:

1. Anderson TW. (1958). An Introduction to Multivariate Statistical Analysis. John Wiley.
2. Dillon WR & Goldstein M. (1984). Multivariate Analysis - Methods and 15 Applications. John Wiley.
3. Goon AM, Gupta MK & Dasgupta B. (1977). An Outline of Statistical Theory. Vol. I. The World Press.
4. AM, Gupta MK and Dasgupta B. (1983). Fundamentals of Statistics. Vol. I. The World Press. Hoel PG. (1971). Introduction to Mathematical Statistics. John Wiley.
5. Hogg RV & Craig TT. (1978). Introduction to Mathematical Statistics. Macmillan.
6. Gupta B.N.(2016). Fundamentals of Statistics, SBPD Publications
7. Learning Statistics: http://freestatistics.altervista.org/en/learning.php. Electronic Statistics Text Book:

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Analytical Techniques and Instrumental Methods in Soil and Plant Analysis
SUBJECT CODE: Soils 5218
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.

Sr. No	Contents	Contact Hours
	PRACTICAL	
	Soil, water and plant sampling techniques, their processing and handling. Estimation of soil texture, electric conductivity, pH and organic carbon.	**30**
	Analysis of soil and plant samples for Nitrogen, Phosphorus, Potassium, Calcium, Magnesium , Sulphur, Zink, Iron, Manganese, Boron and Molybdenum.	
	Analysis of plant materials by digesting plant material by wet and dry ashing and soil by wet digestion methods	

Course Outcomes:

After taking the course, students will be able to:

1. To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.
2. To impart knowledge on Soil, water and plant sampling techniques, their processing and handling.
3. Learn about Analysis of soil and plant samples for nutrients.
4. Analysis of plant materials by digesting plant material by wet and dry ashing and soil by wet digestion methods.

Suggested Books:

1. Dhyan Singh, PK Chhonkar, and DS Dwivedi. Manual on soil, plant and water analysis, Westville Publishing House
2. M.L. Jackson. Soil Chemical Analysis, Prentice Hall Inc.
3. Willard, H.H., Merritt, L.L. Jr.; Dean, J.A.; Settle, F.A. Jr.Instrumental methods of analysis,7th Edition, Wadsworth Publishing Company
4. A. Klute. Methods of soil analysis, Part 1, Physical and Mineralogical Methods (2nd edition), 1986, American Society of Agronomy, Agronomy Monographs 9(1), Madison, Wisconsin
5. C.S. Piper. Soil and plant analysis: a laboratory manual of methods for the examination of soils and the determination of the inorganic constituents of plants, Bombay: Hans. (1966)

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Technical Writing, Communication Skills, Library and Information Services
SUBJECT CODE: APGS 5211
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
1	0	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To impart the knowledge of technical writing and use of library resources and books

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Technical Writing-Various forms of technical writing-theses, technical papers, reviews, electronic communication etc; qualities of technical writing; parts of research communications- title page, content page, authorship, preface, introduction, review of literature, materials and methods, experimental results	**08**
UNIT-II	Documentation; photographs and drawings with suitable captions; pagination; citations; writing of abstracts; précis; synopsis; editing and proof reading. Communication Skills-defining communication; types of communication- verbal and non-verbal; assertive communication; assertive 445 communication; using language for effective communication	**04**
UNIT-III	Techniques of dyadic communication- message pacing and message chunking, self disclosure, mirroring, expressing conversational intent; paraphrasing; vocabulary building- word roots, prefixes, Greek and Latin roots.	**03**
	PRACTICAL	
	Editing and Proof reading technical articles; using language tools for effective writing; listening to audio-video conversations aimed at testing the comprehension of the students; oral presentations on a given topic related to agriculture; evaluation of body language and communication skills based on group discussions and interviews; role plays and pronunciation exercises; using eye contact and visual clues for effective listening skills; word stress application and voice modulation; soft skills; rhetoric skills; self-assessment exercises. Introduction to Library and its services; Five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information-primary, secondary and tertiary; current awareness and SDI services; tracing information from reference sources; library survey; preparation of bibliography; use of Online Public Access Catalogue; use of CD-ROM databases and other computerized library services, CeRA, J-Gate; use of Internet including search engines and its resources; e-resources and access methods.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Learn that what the various forms of scientific writings are.

2. Learn how to write the various parts of thesis, research communications. Learn how to do writing of abstracts, summaries and what are citations etc.

3. Learn research communications, illustrations, photograph, and drawings.

4. Learn pagination, scientific write ups, editing and proof reading, and writing of review article.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

FOURTH SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
Skill Enhancement Compulsory Courses											
AIPR-5221	Intellectual Property Rights and its Management	2	0	0	2	16	---	24	60	100	03
HORT-5099	Master's Research	0	0	16	16	---	---	---	---	---	---
Total		**2**	**0**	**16**	**18**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-IV

SEMESTER IV

SUBJECT TITLE: Intellectual Property Rights and its Management
SUBJECT CODE: AIPR-5221
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs	**05**
UNIT-II	Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection	**05**
UNIT-III	Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.	**06**
	PRACTICAL	
	NA	

Course Outcomes:

After taking the course, students will be able to:

1. Students will be aware of Intellectual Property Rights for ensuring rights for their products.
2. Students will be aware of Indian Legislations for the protection of various types of Intellectual Properties.
3. Students will be aware of Fundamentals of patents, copyrights, geographical indications.
4. Students will be aware of National Biodiversity protection initiatives; Convention on Biological Diversity;

Suggested Books:

1. Erbisch FH and Maredia K.(1998). Intellectual Property Rights in Agricultural Biotechnology. CABI.
2. Ganguli P. (2001). Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
3. Ministry of Agriculture, Government of India. (2004). State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
4. Rothschild M and Scott N. (Ed.). (2003). Intellectual Property Rights in Animal Breeding and Genetics. CABI.
5. Saha R. (Ed.). (2006). Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
6. The Indian Acts - Patents Act, (1970) and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

List of Journals & Magazines

- Acta Horticulture
- American Journal of Horticultural Sciences
- American Potato Growers
- Floriculture Today
- Haryana Journal of Horticulture Science
- Haryana Journal of Horticulture Science
- Horticulture Reviews
- Horticulture Reviews
- HortScience
- IIVR Bulletins
- Indian Horticulture
- Indian Journal of Arid Horticulture
- Indian Journal of Horticulture
- Journal of American Society of Horticultural Sciences
- Journal of Applied Horticulture
- Journal of Horticultural Sciences
- Journal of Horticultural Sciences & Biotechnology
- Journal of Japanese Society for Horticulture Science
- Journal of Korean Society for Horticulture Science
- Journal of Landscape architecture
- Journal of Ornamental Horticulture
- Journal of Plantation Crops

- Journal of Post-harvest Biology and Technology
- Journal of Spices and Aromatic Crops
- Post-harvest Biology and Technology
- Scientia Horticulture
- Seed Research
- Seed Science
- South Indian Horticulture
- Vegetable Grower
- Vegetable Science

Suggested Broad Topics for Master's Research

- Application of genetic engineering in fruit crops and flower crops
- Application of molecular markers in genetic improvement of vegetable crops
- Breeding for extending shelf life of vegetable crops
- Breeding for industrial and processing of vegetable crops
- Breeding for insect-pest and disease resistance
- Breeding for quality improvement
- Canopy management in fruit crops
- Concept of quality control in vegetable seed production
- Crop selection for biotic and abiotic stresses
- Development of transgenic vegetables
- Diagnostic and recommended integrated system in cultivation of fruit crops and floriculture
- Drip/micro irrigation in vegetable crops
- Dry land and coastal farming
- Fertigation in vegetable crops
- Fruit and Flower crops improvement
- Growing vegetables under protected conditions
- Hi-tech home gardening
- Hi-tech methods for raising nursery of vegetable crops
- Integrated nutrients management in vegetable crops
- Micronutrients in vegetable crops
- Micro-propagation of fruit crops and major flower crops
- Minimal processing of vegetables
- Mulching in vegetable crops
- Nutritional and water requirements of flower crops
- Organic farming in fruit and vegetable crops
- Post harvest management of fruit crops and flower crops
- Precision farming in fruit crops and floriculture
- Protected cultivation of fruit crops and flower crops
- Rejuvenation of orchards
- Replant problems in perennial fruit crops

- Research on burning problems in horticulture crops like mango malformation, citrus decline, guava wilt, alternate bearing, etc.
- Research on home storage of vegetable crops
- Research on physiological disorders in vegetable crops
- Research on water management in vegetable crops
- Root distribution studies in fruit crops
- Screening of vegetable s against abiotic stress
- Use of molecular markers in fruit crops and flower crops
- Value addition in fruit crops and flower crops

M.Sc. Agriculture (Plant Pathology)

FIRST SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
Core Courses											
AGPP-5111	Mycology	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGPP-5112	Principles of Plant Pathology	4	0	0	4	16	---	24	60	100	03
AGPP-5113	Detection and Diagnosis of Plant Diseases (Lab)	0	0	6	3	----	60	-----	40	100	03
APPP-5111	Principles of Plant Physiology	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5111	Tropical and Dry land Horticulture	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Total		**12**	**0**	**12**	**18**						

L-- Lecture T-- Tutorial P---Practical

CWA Class work Assessment

LWA Lab work Assessment

MTE Mid Term Exam

ETE End Term Exam

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-I

Program Name: M. Sc Agriculture
Program Code: AG 403

Detailed Syllabus

SEMESTER I

SUBJECT TITLE: Mycology
SUBJECT CODE: AGPP-5111
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To study the nomenclature, classification and characters of fungi.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Introduction, definition of different terms, basic concepts. Importance of mycology in agriculture, relation of fungi to human affairs, history of mycology.	**15**
UNIT-II	Concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.	**10**
UNIT-III	The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Lichens types and importance, fungal genetics and variability in fungi.	**20**
	PRACTICAL	
	• Detailed comparative study of different groups of fungi. • Collection, identification and preservation of specimens. • Isolation and identification of plant pathogenic fungi. Lectures	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Understand the world of microbes, fungi and lichens. Appreciate the adaptive strategies of the microbes, fungi and lichens
2. Learn about nomenclature and classification, fungal biodiversity, reproduction in fungi.
3. Know Collection, identification and preservation of specimens
4. Get hands on experience on Isolation and identification of plant pathogenic fungi

Suggested Books:

1. Ainsworth GC, Sparrow FK & Susman HS. 1973. The Fungi – An Advanced Treatise. Vol. IV (A & B). Academic Press, New York.
2. Alexopoulos CJ, Mims CW & Blackwell M.2000. Introductory Mycology.5th Ed. John Wiley & Sons, New York.
3. Mehrotra RS & Arneja KR. 1990. An Introductory Mycology. WileyEastern, New Delhi.
4. Sarbhoy AK. 2000. Text book of Mycology. ICAR, New Delhi.
5. Singh RS. 1982. Plant Pathogens – The Fungi. Oxford & IBH, New Delhi.
6. Webster J. 1980. Introduction to Fungi. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Principles of Plant Pathology
SUBJECT CODE: AGPP-5112
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To introduce the subject of Plant Pathology, its concepts and principles.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases. Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development.	**20**
UNIT-II	Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst.	**15**
UNIT-III	Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens. Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance.Disease management strategies.	**25**
	PRACTICAL	
	NA	

Course Outcomes:

After taking the course, students will be able to:

1. Study of important taxonomic characters and symptoms produced by important microorganisms in order to manage them
2. Learn about Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development.
3. Knowlwdge on Host parasite interaction
4. Knowledge on Phenolics, Phytoalexins, PR proteins, Elicitors.

Suggested Books:

1. Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York.
2. Heitefuss R & Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin, New York.
3. Mehrotra RS & Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi.

4. Singh RS. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH, New Delhi.
5. Singh DP & Singh A. 2007. Disease and Insect Resistance in Plants Oxford & IBH, New Delhi.
6. Upadhyay RK & Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

SUBJECT TITLE: Detection and Diagnosis of Plant Diseases
SUBJECT CODE: AGPP-5113
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	6	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.

Sr. No	Contents	Contact Hours
	PRACTICAL	
UNIT-I	Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens. Preservation of plant pathogens and disease specimens.	**30**
UNIT-II	Use of centrifuge, pH meter, micrometer, haemocytometer, camera lucida. Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus.	**30**
UNIT-III	Disease diagnostics, serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of manuscripts.	**30**

Course Outcomes:

After taking the course, students will be able to:
1. Describe the methods to prove Koch's postulates with biotope and necrotroph pathogens,
2. Know pure culture techniques, use of selective media to isolate pathogens. Explain the 3. Learn about preservation of plant pathogens and disease specimens.
4. Learn use of haemocytometer, micrometer, centrifuge, pH meter, cameralucida.

Suggested Books:

1. Baudoin ABAM, Hooper G R, Mathre D E & Carroll R B. 1990. Laboratory Exercises in Plant Pathology: An Instructional Kit. Scientific Publ., Jodhpur.
2. Dhingra O D & Sinclair J B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
3. Pathak V N. 1984. Laboratory Manual of Plant Pathology. Oxford & IBH, New Delhi.
4. Matthews R E F. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Florida.
5. Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Cent. Agic. Pub. Doc. Wageningen.]
6. Gullino M.L. and Bonates L. 2014.Detection and Diagnosis of Plant Diseases, Springer.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Tropical and Dry land Horticulture
SUBJECT CODE: HORT-5111

SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

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

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	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 production.of tropical and dry land fruits.	**15**
UNIT-II	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.of tropical and dry land fruits	**15**
UNIT-III	Industrial and export potential, Agri. Export Zones (AEZ) and industrial supports. Crops Mango and Banana, Papaya, Coconut and Cashew nut, Sapota and Jackfruit, Pineapple and Annonas, Aonla, Pomegranate, Phalsa and Ber, minor fruits of tropics (Mahua, Lasoda, Mulberry, Tamarind and Chironji).	**15**
	PRACTICAL	
	• Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analysis of quality attributes. • Practices of important agro-techniques, visit to tropical and arid zone orchards. • Project preparation for establishing commercial orchards.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Impart basic knowledge about the importance and management of tropical and dry land Horticulture crops grown in India.
2. Brief knowledge of commercial varieties of regional, national and international importance eco-physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping system, root zone and canopy management, nutrient management, water management, fertigation.
3. 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, harvest, grading, packing.
4. Storage and ripening techniques; industrial and export potential, Agri. Export Zones (AEZ) and industrial support.

Suggested Books:

1. Bose, TK, Mitra, SK & Rathore, DS. (Eds.). 1988. Temperate Fruits - Horticulture. Allied Publ.
2. Bose, T.K, Mitra, S.K & Sanyal, D. 2001. (Eds.). Fruits -Tropical and Subtropical. Naya Udyog.
3. Chadha, K.L & Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. II- IV. Malhotra Publ. House.
4. Nakasone, H.Y & Paul, R.E. 1998. Tropical Fruits. CABI. Peter, K.V. 2008. (Ed.). Basics of Horticulture. New India Publ. Agency.
5. Pradeep Kumar T, Suma B, Jyothi Bhaskar & Satheesan, K.N. 2008. Management of Horticultural Crops. Parts I, II. New India Publ. Agency.
6. Singh HP, Negi JP& Samuel JC. (Eds.). 2002. Approaches for Sustainable Development of Horticulture. National Horticultural Board.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SECOND SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total	
Core Courses											
AGPP-5124	Plant Bacteriology	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGPP-5125	Diseases of Vegetable and Spices Crops	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGPP-5126	Ecology of Soil-Borne Plant Pathogens	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5124	Seed Production Technology of Vegetable Crops	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
HORT-5125	Postharvest Technology for Fruit Crops	2	0	0	2	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
SkillEnhancementCompulsoryCourses											
AGPP-5099	Master's Research	0	0	3	3	---	---	---	---	---	---
Total		**10**	**0**	**13**	**18**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-II

SEMESTER II

SUBJECT TITLE: Plant Bacteriology
SUBJECT CODE: AGPP-5124
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To acquaint the students with plant pathogenic prokaryote (procarya) and their structure, nutritional requirements, survival and dissemination

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Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	History and introduction to phytopathogenic procarya, viz., bacteria, MLOs, spiroplasmas and other fastidious procarya. Importance of phytopathogenic bacteria.	**10**
UNIT-II	Evolution, classification and nomenclature of phytopathogenic procarya and list of important diseases caused by them. Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya.	**12**
UNIT-III	General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios. Procaryotic inhibitors and their mode of action against phytopathogenic bacteria. Survival and dissemination of phytopathogenic bacteria.	**08**
	PRACTICAL	
	• Isolation, purification, identification and host inoculation of phytopathogenic bacteria. • Staining methods, biochemical and serological characterization. • Isolation of plasmid and use of antibacterial chemicals/antibiotics.	**30**

Course Outcomes:

After taking the course, students will be able to:
1. Develop an understanding of importance of phytopathogenic bacteria and to study in detail about different phytopathogenic bacteria such as MLOs, spiroplasmas, fastidious bacteria
2. Develop an procedure for understanding of evolution, classification and nomenclature of plantpathogenic bacteria.
3. Describe a procedure for understanding of growth nutrients, reproduction and preservation of bacterial cultures.
4. Understand the general biology of bacteriophages, L form bacteria and plasmids

Suggested Books:

1. Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, NewYork.
2. Jayaraman J & Verma JP. 2002. Fundamentals of Plant Bacteriology. Kalyani Publ., Ludhiana.
3. Mount MS & Lacy GH. 1982. Phytopathogenic Prokaryotes. Vols. I, II. Academic Press, New York.
4. Verma JP, Varma A & Kumar D. (Eds). 1995. Detection of Plant pathogens and their Management. Angkor Publ., New Delhi.
5. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Diseases of Vegetable and Spices Crops
SUBJECT CODE: AGPP-5125
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart knowledge about symptoms, epidemiology of different diseases of vegetables and spices and their management.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Nature, prevalence, factors affecting disease development of bulb, leafy vegetable, crucifers, cucurbits and solanaceaous vegetables.	**08**
UNIT-II	Diseases of protected cultivation. Symptoms and management of diseases of different root, bulb, leafy vegetables, crucifers, cucurbits and solanaceaous vegetable crops.	**08**
UNIT-III	Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger.	**14**
	PRACTICAL	
	Detailed study of symptoms and host pathogen interaction of important diseases of vegetable and spice crops.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Describe the disease resistance and molecular approach for disease management.
2.Undersatand prevalence, factors affecting disease development of bulb, leafy vegetable, crucifers, cucurbits and solanaceaous vegetables.
3. Understand Symptoms, epidemiology and management of diseases of different spice crops.
4. Know about host pathogen interaction of important diseases of vegetable and spice crops.

Suggested Books:

1. Chaube HS, Singh US, Mukhopadhyay AN & Kumar J. 1992. Plant Diseases of International Importance. Vol. II. Diseases of Vegetable and Oilseed Crops. Prentice Hall, Englewood Cliffs, New Jersey.
2. Godara, S, l, Kapoor, BBS and Rathore, B.S. 2010. Madhu Publications, Bikaner-3, India.
3. Gupta VK & Paul YS. 2001. Diseases of Vegetable Crops. Kalyani Publ., New Delhi
4. Columbia. Singh RS. 1999. Diseases of Vegetable Crops. Oxford & IBH, New Delhi.
5. Gupta SK & Thind TS. 2006. Disease Problem in Vegetable Production. Scientific Publ., Jodhpur.6
6. Walker JC. 1952. Diseases of Vegetable Crops. McGraw-Hill, New York.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Ecology of Soil-Borne Plant Pathogens
SUBJECT CODE: AGPP-5126
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart knowledge on soil-plant disease relationship.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi.	**10**
UNIT-II	Types of biocontrol agents. Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis.	**12**
UNIT-III	Suppressive soils, biological control- concepts and potentialities for managing soil borne pathogens.	**13**
	PRACTICAL	
	• Quantification of rhizosphere and rhizoplane microflora with special emphasis on pathogens. • Pathogenicity test by soil and root inoculation techniques, correlation between inoculum density of test pathogens and disease incidence, demonstration of fungistasis in natural soils. • Suppression of test soil-borne pathogens by antagonistic microorganisms. Isolation and identification of different biocontrol agents.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Become familiar with specific components of the soil environment that affect soilborne plant pathogens, roots and the infection process
2. Learn about Types of biocontrol agents.
3. Understand Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis.
4. Study Quantification of rhizosphere and rhizoplane microflora with special emphasis on pathogens

Suggested Books:

1. Baker KF & Snyder WC. 1965. Ecology of Soil-borne Plant Pathogens. John Wiley, New York.
2. Cook RJ & Baker KF. 1983. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, Minnesota.
3. Garret SD. 1970. Pathogenic Root-infecting Fungi. Cambridge Univ. Press, Cambridge, New York.
4. Hillocks RJ & Waller JM. 1997. Soil-borne Diseases of Tropical Crops. CABI, Wallington.
5. Parker CA, Rovira AD, Moore KJ & Wong PTN. (Eds). 1983. Ecology and Management of Soil-borne Plant Pathogens. APS, St. Paul, Minnesota.
6. Rajgopalan R. 2017. nvironment & Ecology - A Complete Guide , OakBridge Private Limited

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Seed Production Technology of Vegetable Crops
SUBJECT CODE: HORT-5124
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To educate students about principles and methods of quality seed and planting material production in vegetable crops.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India. Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production.	**10**
UNIT-II	Floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production. Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards.	**08**
UNIT-III	Seed act and law enforcement, plant quarantine and quality control. Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology. Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra.	**12**
	PRACTICAL	
	Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing; testing, releasing and notification procedures of varieties; floral biology. Rouging of off-type; methods of hybrid seed production in important vegetable and spice crops; seed extraction techniques; handling of seed processing and seed testing equipments. Seed sampling; testing of vegetable seeds for seed purity, germination, vigour and health; visit to seed processing units, seed testing laboratory and seed production farms.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Educate principles and methods of quality seed and planting material production in vegetable crops.
2. Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India.
3. Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production
4. Knowledge of floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production.

Suggested Books:

1. Agrawal PK & Dadlani M. (Eds.). 1992. Techniques in Seed Science and Technology. South Asian Publ.
2. Agrawal RL. (Ed.). 1997. Seed Technology. Oxford & IBH.
3. Bendell PE. (Ed.). 1998. Seed Science and Technology: Indian Forestry Species. Allied Publ.
4. Fageria MS, Arya PS & Choudhary AK. 2000. Vegetable Crops: Breeding and Seed Production. vol. I. Kalyani.
5. George RAT. 1999. Vegetable Seed Production. 2nd Ed. CABI.
6. Kumar JC & Dhaliwal MS. 1990. Techniques of Developing Hybrids in Vegetable Crops. Agro Botanical Publ.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: **Postharvest Technology for Fruit Crops**
SUBJECT CODE: HORT-5125
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	2	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective and outcome of course: To facilitate deeper understanding on principles and practices of post harvest management of fruit crops.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration. Physiology and biochemistry of fruit ripening.	**10**
UNIT-II	Ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling. Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, physical injuries and disorders.	**10**
UNIT-III	Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juice, beverages, pickles, jam, jellies, sauces and ketchup, candies, preserve. Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards.	**10**
	PRACTICAL	
	• Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables. • Estimation of transpiration, respiration rate, ethylene release and study of shelf life extension in cut flower using chemicals, estimation of quality characteristics in stored fruits and vegetables. • Practices of preservation by salt, sugar, vinegar and chemical preservatives, cold chain management -visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Facilitate deeper understanding on principles and methods of postharvest management of Fruit crops.
2. Maturity indices, harvesting practices for specific market requirements, influence of pre and post-harvest practices, respiration, transpirational loss.
3. Physiology and biochemical change during ripening, senescence, ethylene evolution and ethylene management, factors leading to post-harvest loss and its control, pre- cooling.
4. Study of post-harvest loss and their control.

Suggested Books:

1. Bhutani R.C. 2003. Fruit and Vegetable Preservation. Biotech Books.
2. Chadha K.L & Pareek O.P. (Eds.). 1996 Advances in Horticulture. Vol. IV. Malhotra Publ. House.
3. Haid N.F & Salunkhe S.K. 1997. PostHarvest Physiology and Handling of Fruits and Vegetables. Grenada Publ.
4. Mitra S.K. 1997. Post-Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI.
5. Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.
6. Sudheer K.P & Indira V. 2007. Post-Harvest Technology of Horticultural Crops. New India Publ. Agency.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

THIRD SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
Core Courses											
AGPP-5217	Principles of Plant Disease Management	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Ability Enhancement Compulsory Courses											
ASTA-5211	Statistical Methods for Agricultural Research	3	0	0	3	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
Skill Enhancement Compulsory Courses											
APGS-5211	Technical Writing, Communication Skills, Library and Information Services	1	0	0	1	16	---	24	60	100	03
	Lab	0	0	2	1	----	60	-----	40	100	03
AGPP-5091	Master's Seminar	1	0	0	1	00	---	00	100	100	00
AGPP-5099	Master's Research	0	0	7	7	---	---	---	---	---	---
Total		**8**	**0**	**13**	**18**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-III

SEMESTER III

SUBJECT TITLE: Principles of Plant Disease Management
SUBJECT CODE: AGPP-5217
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To acquaint students with various strategies for management of plant diseases.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases.	**12**
UNIT-II	Disease resistance and molecular approach for disease management. Foliage, seed and soil application of chemicals, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects and safety measures.	**18**
UNIT-III	History of fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.	**15**
	PRACTICAL	
	• In vitro and in vivo evaluation of chemicals and bioagents against plant pathogens. • ED and MIC values, study of structural and functional details of sprayers and dusters.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. Explain the principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases.
2. Learn Disease resistance and molecular approach for disease management.
3. Understand fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy.
4. Get an insight about *in -vitro* and *in-vivo* evaluation of chemicals and bioagents against plant pathogens.

Suggested Books:

1. Fry WE. 1982. Principles of Plant Disease Management. Academic Press, New York.
2. Hewitt HG. 1998. Fungicides in Crop Protection. CABI, Wallington.
3. Marsh RW. 1972. Systemic Fungicides. Longman, New York.
4. Nene YL & Thapliyal PN. 1993. Fungicides in Plant Disease Control. Oxford & IBH, N Delhi.
5. Palti J. 1981. Cultural Practices and Infectious Crop Diseases. Springer- Verlag, New York.
6. Taiz L & Zeiger E. 2006. *Plant Physiology*. 4th Ed. Sinauer Associates.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Statistical Methods for Agricultural Research
SUBJECT CODE: ASTA-5211
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	2	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To acquaint with basic statistical methods and their application in agricultural research

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error.	**15**
UNIT-II	Simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests.	**15**
UNIT-III	Confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.	**15**
	PRACTICAL	
	Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.	**30**

Course Outcomes:

After taking the course, students will be able to:

1. The students can understand the statistical concepts applied in agricultural research.
2. Can apply statistical tools in design of experiments.
3. Can acquire skills in analyzing statistical data efficiently.
4. Can acquire skills on Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

Suggested Books:

1. Anderson TW. (1958). An Introduction to Multivariate Statistical Analysis. John Wiley.
2. Dillon WR & Goldstein M. (1984). Multivariate Analysis - Methods and 15 Applications. John Wiley.
3. Goon AM, Gupta MK & Dasgupta B. (1977). An Outline of Statistical Theory. Vol. I. The World Press.
4. AM, Gupta MK and Dasgupta B. (1983). Fundamentals of Statistics. Vol. I. The World Press. Hoel PG. (1971). Introduction to Mathematical Statistics. John Wiley.
5. Hogg RV & Craig TT. (1978). Introduction to Mathematical Statistics. Macmillan.
6. Gupta B.N.(2016). Fundamentals of Statistics, SBPD Publications
7. Learning Statistics: http://freestatistics.altervista.org/en/learning.php. Electronic Statistics Text Book:

Program Name: M. Sc Agriculture
Program Code: AG 403

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

SUBJECT TITLE: Technical Writing, Communication Skills, Library and Information Services
SUBJECT CODE: APGS 5211
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
1	0	2	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: To impart the knowledge of technical writing and use of library resources and books

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Technical Writing-Various forms of technical writing-theses, technical papers, reviews, electronic communication etc; qualities of technical writing; parts of research communications- title page, content page, authorship, preface, introduction, review of literature, materials and methods, experimental results	**08**
UNIT-II	Documentation; photographs and drawings with suitable captions; pagination; citations; writing of abstracts; précis; synopsis; editing and proof reading. Communication Skills-defining communication; types of communication- verbal and non-verbal; assertive communication; assertive 445 communication; using language for effective communication	**04**
UNIT-III	Techniques of dyadic communication- message pacing and message chunking, self disclosure, mirroring, expressing conversational intent; paraphrasing; vocabulary building- word roots, prefixes, Greek and Latin roots.	**03**
	PRACTICAL	
	Editing and Proof reading technical articles; using language tools for effective writing; listening to audio-video conversations aimed at testing the comprehension of the students; oral presentations on a given topic related to agriculture; evaluation of body language and communication skills based on group discussions and interviews; role plays and pronunciation exercises; using eye contact and visual clues for effective listening skills; word stress application and voice modulation; soft skills; rhetoric skills; self-assessment exercises. Introduction to Library and its services; Five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information-primary, secondary and tertiary; current awareness and SDI services; tracing information from reference sources; library survey; preparation of bibliography; use of Online Public Access Catalogue; use of CD-ROM databases and other computerized library services, CeRA, J-Gate; use of Internet including search engines and its resources; e-resources and access methods.	**30**

Course Outcomes:

After taking the course, students will be able to:
1. Learn that what the various forms of scientific writings are.

2. Learn how to write the various parts of thesis, research communications. Learn how to do writing of abstracts, summaries and what are citations etc.

3. Learn research communications, illustrations, photograph, and drawings.

4. Learn pagination, scientific write ups, editing and proof reading, and writing of review article.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.

Program Name: M. Sc Agriculture
Program Code: AG 403

FOURTH SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**		**CWA**	**LWA**	**MTE**	**ETE**	**Total**	
Skill Enhancement Compulsory Courses											
AIPR-5221	Intellectual Property Rights and its Management	2	0	0	2	16	---	24	60	100	03
AGPP-5099	Master's Research	0	0	16	16	---	---	---	---	---	---
Total		**2**	**0**	**16**	**18**						

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

Program Name: M. Sc Agriculture
Program Code: AG 403

SYLLABUS

SEMESTER-IV

SEMESTER IV

SUBJECT TITLE: Intellectual Property Rights and its Management
SUBJECT CODE: AIPR-5221
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective of course: The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Sr. No	Contents	Contact Hours
	THEORY	
UNIT-I	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs	**05**
UNIT-II	Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection	**05**
UNIT-III	Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.	**06**
	PRACTICAL	
	NA	

Course Outcomes:

After taking the course, students will be able to:

1. Students will be aware of Intellectual Property Rights for ensuring rights for their products.
2. Students will be aware of Indian Legislations for the protection of various types of Intellectual Properties.

3. Students will be aware of Fundamentals of patents, copyrights, geographical indications.
4. Students will be aware of National Biodiversity protection initiatives; Convention on Biological Diversity;

Suggested Books:

1. Erbisch FH and Maredia K.(1998). Intellectual Property Rights in Agricultural Biotechnology. CABI.
2. Ganguli P. (2001). Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
3. Ministry of Agriculture, Government of India. (2004). State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
4. Rothschild M and Scott N. (Ed.). (2003). Intellectual Property Rights in Animal Breeding and Genetics. CABI.
5. Saha R. (Ed.). (2006). Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
6. The Indian Acts - Patents Act, (1970) and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

Instruction of Question Paper setter: The question paper comprises 12 multiple choice question, each of 1 Marks; 6 short type answer questions, each of 4 Marks and 3 explanatory questions, each of 8 Marks.