Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

VIT SCHOOL OF AGRICULTURAL INNOVATIONS AND ADVANCED LEARNING

Curriculum and Syllabus

(As per ICAR 5th Deans' Committee Report)

B.Sc. (Hons.) Agriculture Programme

VIT – A place to learn, A chance to grow

VIT®
Vellore Institute of Technology
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VISION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

Transforming life through excellence in education and research.

MISSION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

World class Education: Excellence in education, grounded in ethics and critical thinking, for improvement of life.

Cutting edge Research: An innovation ecosystem to extend knowledge and solve critical problems.

Impactful People: Happy, accountable, caring and effective workforce and students.

Rewarding Co-creations: Active collaboration with national & international industries & universities for productivity and economic development.

Service to Society: Service to the region and world through knowledge and compassion.

VISION STATEMENT OF THE SCHOOL OF AGRICULTURAL INNOVATIONS AND ADVANCED LEARNING

To be a forerunner in developing and demonstrating sustainable smart agriculture to combat the global challenges of next-generation farming.

MISSION STATEMENT OF THE SCHOOL OF AGRICULTURAL INNOVATIONS AND ADVANCED LEARNING

1. To offer world class learning and training experience to the students in science, technology and business aspects of agriculture.

2. To serve the farming community with custom-designed technologies for improved agricultural production and enhanced productivity.

3. To innovate globally competent novel technologies for uplifting the agro-industry.

CURRICULUM applicable from the academic year, 2024-25 onward

BREAK-UP OF COURSES		
Sl.No.	**Category**	**Credits**
1	Programme Core	171
2	Programme Elective	9
Recommended Total Number of Credits (as per the inclusion of Remedial Course Credits)		181/183/184 (PCMB/PCB and PCM/Agri)
Minimum Total Number of Credits		**180**

Programme Core includes **5 credits of NON GRADIAL** courses (EXCAG101/EXCAG102/EXCAG103, HUMAG101 & EDTAG201)

NON GRADIAL course is a course wherein a registered student has to be graded as **PASS/FAIL**. They are **mandatory credit courses** but should not be included towards CGPA calculation.

B.Sc. (Hons.) Agriculture: Syllabi (2024-25 onwards)

Course Code	Course Title	Course Type	L	T	P	C	Prerequisite
Programme Core (Credits to be earned: 171)							
Remedial/Bridge Courses (Gradial, not considered for GPA)							
REMAG101	Introductory Biology	Embedded T & L	1	0	2	2	None
REMAG102	Elementary Mathematics	Theory	2	0	0	2	None
REMAG103	Agricultural Heritage	Theory	1	0	0	1	None

Course code	**Introductory Biology**	**L**	**T**	**P**	**C**
REMAG101		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the mechanisms of natural selection and evolution
2. Discussing the fundamentals of plant biology and taxonomy
3. Differentiating prokaryotes from eukaryotes

Expected Course Outcome: At the end of the course the student should be able to

1. Compare living organisms
2. Classify and name living beings
3. Describe cell and its division
4. Interpret flowering plants and state the role of animals in agriculture
5. Illustrate theory of life
6. Describe plant organs and gain interest in learning biological sciences

Module:1	**Introduction to the living world**	**2 hours**
Characteristics of living things: Growth, development, reproduction, regulation and homoeostasis.		
Module:2	**Diversity**	**3 hours**
Diversity of Life: Major domains/kingdoms- Bacteria (Eubacteria), Archaea Archebacteria) and Eukarya. Salient features, classification and alternation of generations in Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.		
Module:3	**Origin of Life**	**3 hours**
Theories: Special creation, extra-terrestrial and spontaneous, Miller-Urey's experiment and path of evolution of chemical molecules of living beings. Origin of cells – Endosymbiotic theory and Bubble theory. Theories of evolution.		
Module:4	**Nomenclature**	**2 hours**
Nomenclature of living beings: Importance of classification and nomenclature, polynomial, binomial and trinomial systems.		
Module:5	**Cell and Cell Division**	**2 hours**
Cell structure and organization of plants and animals - Cell theory and cell as the basic unit of life. Prokaryotic, plant and animal cell. Mitosis and meiosis.		
Module:6	**Flowering plants**	**2 hours**
Roots, Stems, Leaves and their modifications. Types of inflorescences and flowers. Monocots and dicots seeds and their germination. Plant systematics: Brassicaceae, Fabaceae and Poaceae.		
Module:7	**Role of animals in agriculture**	**1 hours**
Animals of draught, milch, meat, fur, wool and manure		
Module:8	**Contemporary Issues**	**1 hour**
Visit to a biological museum		
	Total Lecture hours:	**16**
Text Book		
1.	Peter H. Raven, George B. Johnson, Kenneth A. Mason, Jonathan Losos and Tod Duncan. Biology, 12thedition, 2019. McGraw Hill Publications. U.K.	
Reference Books		
1.	Neil A. Campbell, Urry, L.A., Cain, M.I., Wasserman, S.A., P. V. Minorsky and J.B. Reece. 2018. Biology: A Global Approach, Pearson Education Ltd, Essex, England. UK.	
2.	Bidlack, J., S. Jansky and K. Stern. Stern's Introductory Plant Biology. 14th edition. 2017. McGraw-Hill Publishing Company. UK.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		**CO: 6**
1.	External morphology and internal anatomy of monocot roots- Rice and Maize	**2.5 hours**
2.	External morphology and internal anatomy of dicot roots- Brassica and any legume.	**2.5 hours**
3.	External morphology and internal anatomy of monocot stem- Rice and Maize	**2.5 hours**
4.	External morphology and internal anatomy of dicot stem- Brassica and any legume.	**2.5 hours**
5.	External morphology and internal anatomy of monocot leaf- Rice and Maize	**2.5 hours**

6.	External morphology and internal anatomy of dicot leaf- Brassica and any legume.	**2.5 hours**
7.	Modifications of roots	**2.5 hours**
8.	Modifications of stems	**2.5 hours**
9.	Modifications of leaves and fruits	**2.5 hours**
10.	Analyzing permanent slides - Parenchyma, collenchyma and sclerenchyma.	**2.5 hours**
11.	Study of mitosis in onion root tip cells	**2.5 hours**
12.	Internal anatomy of ovary of monocots- Any millet	**2.5 hours**
13.	Internal anatomy of ovary of dicots - Any legume	**2.5 hours**
14.	Study on floral biology of an example specimen belonging to Fabaceae family.	**2.5 hours**
15.	Study on floral biology of an example specimen belonging to Brassicaceae family.	**2.5 hours**
16.	Study on floral biology of an example specimen belonging to Poaceae family.	**2.5 hours**
	Total Laboratory Hours	**40**

Text Books

1.	Bidlack, J., S.Jansky and K. Stern. Laboratory Manual for Stern's Introductory Plant Biology 14th edition. 2017. McGraw-Hill Publishing Company, UK.
2.	Deepak Gupta, D.K. Garg.Introductory Biology: Practical Training. 2021. Namya Press, India.

Reference Books

1.	James D. Mauseth Botany: An Introduction to Plant Biology. 6th Edition. 2016. Jones and Bartlett Learning Inc. Burlington, Wall street, MA, USA.
2.	Neil A. Campbell, Urry, L.A., Cain, M.I., Wasserman, S.A., P. V. Minorsky and J.B. Reece. 2018. Biology: A Global Approach, Pearson Education Ltd, Essex, England. UK.

Mode of Evaluation: Internal assessments and Final assessment test

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Elementary Mathematics**	**L**	**T**	**P**	**C**
REMAG102		**2**	**0**	**0**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Improving the mathematical knowledge of students from a science background
2. Imparting higher secondary level mathematics to bridge requirements of courses
3. Interlinking mathematics with science

Expected Course Outcome: At the end of the course the student should be able to

1. Device formulas for straight lines and comprehend the use of Slope-Intercept
2. Apply the knowledge gained in designing fields and utilize calculus in agriculture
3. Integrate product of functions and define matrices and determinants

Module:1	**Straight Lines**	**4 hours**

Distance formula, section formula (internal and external division), change of axes (only origin changed), equation of co-ordinate axes and equation of lines parallel to axes.		
Module:2	**Slope-Intercept**	**6 hours**
Slope-intercept form of equation of line, slope-point form of equation of line, two point form of equation of line, intercept form of equation of line, normal form of equation of line, general form of equation of line, point of intersection of two straight lines, angles between two straight lines, parallel lines, perpendicular lines, angle of bisectors between two lines, area of triangle and quadrilateral.		
Module:3	**Circle**	**6 hours**
Equation of circle whose centre and radius is known, general equation of a circle, equation of circle passing through three given points, simple problems on equation of circle whose diameter is the line joining two points (x_1, y_1) & (x_2,y_2), tangent and normal to the given circle at the given point, condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.		
Module:4	**Differential Calculus**	**4 hours**
Definition of function, limit and continuity. Simple problems on limit and continuity. Differentiation of x^n , e^x , sinx & cos x from first principle, derivatives of sum, difference, product and quotient of two functions, differentiation of functions of functions, logarithmic differentiation, differentiation by substitution method and simple problems based on it.		
Module:5	**Calculus**	**2 hours**
Differentiation of inverse trigonometric functions. Simple problems on Maxima and Minima of the functions of the form y=f (x).		
Module:6	**Integral Calculus**	**4 hours**
Integration of simple functions, integration of product of two functions and integration by substitution method. Simple problems on definite Integral and area under simple well-known curves.		
Module:7	**Matrices and Determinants**	**4 hours**
Definition of matrices, addition, subtraction, multiplication, transpose and inverse up to 3rd order, properties of determinants up to 3rd order and their evaluation.		
Module:8	**Contemporary Issues**	**2 hour**
Lecture by an expert		
	Total Lecture hours:	**32**

Text Book	
1.	R S Aggarwal. Senior Secondary School Mathematics for Class 12. 2020. Bharati Bhawan (Publishers & Distributors), India.
Reference Books	
1.	Lewingdon Parsons, G. Elementary Differential and Integral Calculus. 2017. Cambridge University Press Publishing Company, UK
2.	Grewal, B.S. 2015. Higher engineering mathematics.43rd edition. Khanna Publishers. India.

Mode of assessment: Assignment, Mid-semester and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Agricultural Heritage**	**L**	**T**	**P**	**C**
REMAG103		**1**	**0**	**0**	**1**

Pre-requisite	None	**Syllabus version**
		1.0

Course Objectives: The course is aimed at

1. Discussing the importance and relevance of agriculture across civilizations
2. Illustrating a lucid picture on Indian agriculture
3. Imparting knowledge on historical best agricultural practices relevant to today's agriculture

Expected Course Outcome: At the end of the course the student should be able to

1. Appreciate agriculture practiced throughout the world
2. Understand the rich agricultural heritage of India
3. Integrate judicious traditional agricultural practices with modern methods, plan on using agricultural resources and comprehend agricultural issues

Module:1	**Scope of Agriculture**	**2 hours**
Scope of agriculture; Crop voyage in India and the world		
Module:2	**Crop Significance**	**2 hours**
Crop significance and classifications; Past and present status of agriculture and farmers in society.		
Module:3	**History of Indian Agriculture**	**2 hours**
Introduction of Indian agricultural heritage; Relevance of heritage to present day agriculture; Ancient agricultural practices		
Module:4	**Indigenous traditional knowledge**	**2 hours**
Plant production and protection through indigenous traditional knowledge.		
Module:5	**Journey of Indian Agriculture**	**2 hours**
Journey of Indian agriculture and its development from past to modern era		
Module:6	**Current scenario**	**2 hours**
Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.		
Module:7	**Indian Agricultural Resources**	**3 hours**
Importance of agriculture and agricultural resources available in India; National agriculture setup in India.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text Books

1.	Parviz Koohaf kanand Miguel A. Altieri. Forgotten Agricultural Heritage: Reconnecting food systems and sustainable development. 2016. Taylor & Francis Group. UK.
2.	Kumari M. Veeral. A Text Book on Agricultural Heritage of India. 2nd edition. 2018. Agrotech Publishing Academy, India.

Reference Books

1.	Jana, B.L. Introductory Agriculture: Ancient Heritage, Agricultural Scenario & Gender Equity in Agriculture. 2015. Pointer Publishers, India.
2.	Introductory Agriculture 2016. http://www.agrimoon.com/introductory-agriculture-icar-ecourse-pdf-books/

Mode of assessment: Assignment, Mid-semester and Final assessment test

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Non-Gradial Courses							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
EXCAG101/ EXCAG102/ EXCAG103	NSS/ NCC/ Physical Education & Yoga Practices	Lab	0	0	0	2	None
HUMAG101	Human Value and Ethics	Theory	1	0	0	1	None
EDTAG201	Educational Tour	Project	0	0	0	2	None

Course code	**NSS/NCC/Physical Education & Yoga Practices**	**L**	**T**	**P**	**C**
EXCAG101/ EXCAG102/ EXCAG103		**0**	**0**	**4**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Evoking social consciousness among students through various working together activities and constructive and creative social work
2. Imparting knowledge on executing democratic leadership, programme development and self-employment
3. Reducing the gap between the educated and uneducated and increase awareness and desire to help sections of society

Expected Course Outcome: At the end of the course the student should be able to

1. Infer physical and mental discipline
2. Practice the gained skills to stay physically fit
3. Develop stamina and improve health and hygiene
4. Improve inter personal skills and work well in a group
5. Develop self-confidence
6. Plan in achieving goals

EXCA1188	**NSS**	**Semester I, II, III and IV**

Following activities are to be taken up under the NSS course:

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
- Understanding youth
- Community mobilization
- Social harmony and national integration
- Volunteerism and shramdan
- Citizenship, constitution and human rights
- Family and society
- Importance and role of youth leadership
- Life competencies

- Youth development programmes
- Health, hygiene and sanitation
- Youth health, lifestyle, HIV AIDS and first aid
- Youth and yoga
- Vocational skill development
- Issues related environment
- Disaster management
- Entrepreneurship development
- Formulation of production oriented project
- Documentation and data reporting
- Resource mobilization
- Additional life skills
- Activities directed by the Central and State Government

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years.

A student enrolled in NSS course should put in at least **60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year.** Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Semester I: National Service Scheme I
Introduction and basic components of NSS

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities : Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth - Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilization - Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership

Social harmony and national integration - Indian history and culture, role of youth in nation building, conflict resolution and peace building

Volunteerism and shramdan - Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights - Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society - Concept of family, community (PRIs and other community based organisations) and society

Semester II : National Service Scheme II

Importance and role of youth leadership - Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies - Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes - Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation - Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid - Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga - History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Semester III : National Service Scheme III

Vocational skill development - To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment - Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management - Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development - Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project - Planning, implementation, management and impact assessment of project

Documentation and data reporting - Collection and analysis of data, documentation and dissemination of project reports

Semester IV: National Service Scheme IV

Youth and crime - Sociological and psychological factors influencing youth crime, cyber-crime, pear mentoring in preventing crime and awareness for juvenile justice

Civil/self defence - Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource mobilisation - Writing a project proposal of self-fund units (SFUs) and its establishment

Additional life skills - Positive thinking, self-confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

EXCAG102	**NCC**	**Semester I and II**

Semester I: National Cadet Corps

Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.

Drill- aim, general words of command, attention, stands at ease, stand easy and turning.

Sizing, numbering, forming in three ranks, open and close order march and dressing.

Saluting at the halt, getting on parade, dismissing and falling out.

Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.

Turning on the march and wheeling. Saluting on the march.
Marking time, forward march and halt.
Changing step, formation of squad and squad drill.
Command and control, organization, badges of rank, honours and awards
Nation Building- cultural heritage, religions, traditions and customs of India. National integration.
Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
Leadership traits, types of leadership. Character/personality development.
Civil defense organization, types of emergencies, firefighting, protection,
Maintenance of essential services, disaster management, aid during development projects.
Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
Structure and function of human body, diet and exercise, hygiene and sanitation.
Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
Adventure activities
Basic principles of ecology, environmental conservation, pollution and its control.
Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self-defense.

Semester II: National Cadet Corps

Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
Shoulder from the order and vice-versa, present from the order and vice-versa.
Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice- versa.
Guard mounting, guard of honour, Platoon/Coy Drill.
Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
Loading, cocking and unloading. The lying position and holding.
Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
Characteristics of Carbine and LMG.
Introduction to map, scales and conventional signs. Topographical forms and technical terms.
The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
Knots and lashings, Camouflage and concealment, Explosives and IEDs.
Field defenses obstacles, mines and mine lying. Bridging, waterman ship
Field water supplies, tracks and their construction.
Nuclear, Chemical and Biological Warfare (NCBW)
Judging distance. Description of ground and indication of landmarks.
Recognition and description of target. Observation and concealment. Field signals. Section formations.
Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.

Types of communication, media, latest trends and developments.

EXCAG103	Physical Education and Yoga Practices	Semester I and II

Semester I: Physical Education and Yoga Practices

Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)

Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)

Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game

Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation

Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation

Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game

Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation

Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation

Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game

Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation

Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game

Teaching of some of Asanas – demonstration, practice, correction and practice

Teaching of some more of Asanas – demonstration, practice, correction and practice

Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation

Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation

Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game

Teaching – Meaning, Scope and importance of Physical Education

Teaching – Definition, Type of Tournaments

Teaching – Physical Fitness and Health Education

Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

Semester II: Physical Education and Yoga Practices

Teaching of skills of Hockey – demonstration practice of the skills and correction.

Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation

Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game

Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.

Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation

Teaching of advance skills of Kho-Kho – demonstration practice of the skills and

correction. Involvement of all the skills in games situation with teaching of rules of the game Teaching of different track events – demonstration practice of the skills and correction. Teaching of different track events – demonstration practice of the skills and correction. Teaching of different track events – demonstration practice of the skills and correction with competition among them. Teaching of different field events – demonstration practice of the skills and correction. Teaching of different field events – demonstration practice of the skills and correction. Teaching of different field events – demonstration practice of the skills and correction. Teaching of different field events – demonstration practice of the skills and correction with competition among them. Teaching of different asanas – demonstration practice and correction. Teaching of different asanas – demonstration practice and correction. Teaching of different asanas – demonstration practice and correction. Teaching of different asanas – demonstration practice and correction. Teaching of weight training – demonstration practice and correction. Teaching of circuit training – demonstration practice and correction. Teaching of calisthenics – demonstration practice and correction. **Note: 1)** Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities.
Mode of Evaluation: Internal assessments

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Human Values and Ethics**	**L**	**T**	**P**	**C**
HUMAG101		**1**	**0**	**0**	**1**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Inculcating moral values and ethical standards in students
2. Diffusing knowledge on social and emotional intelligence
3. Appreciating the need and importance of physical, emotional and social heal

Expected Course Outcome: At the end of the course the student should be able to

1. Follow sound morals and ethical values
2. Exhibit mental strength and develop social intelligence
3. Be morally sound, ethically scrupulous and live as a good citizen

Module:1	**Introduction**	**2 hours**
Values and ethics: Intrinsic and extrinsic values, norms, morals, goals and missions.		
Module:2	**Vision of life**	**2 hours**
Vision of life: principles and philosophies.		
Module:3	**Self-discovery**	**2 hours**
Self-exploration, self-awareness, self-reflection, process of self-discovery		
Module:4	**Self-satisfaction**	**2 hours**
Self-actualization, self-development, self-mastery and self-satisfaction		

Module:5	**Process**	**3 hours**
Decision making. Motivation. Sensitivity. Success. Selfless Service.		
Module:6	**Case studies**	**2 hours**
Ethical lives, positive spirit, body, mind and soul. Attachment and detachment.		
Module:7	**Case studies**	**2 hours**
Spirituality Quotient. Examination.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by Industry Expert		
	Total Lecture hours:	**16**

Text Books	
1.	Som Kolekar. A Compass and Atlas for Life: Self-Exploration, Self-Discovery and Self-Awareness. 2021. Notion Press, Chennai, India.
2.	Naagarazan, R. S. A Textbook on Professional Ethics and Human Values. 2020. New Age International Private Limited. Delhi, India.
Reference Books	
1.	Sarah Banks. Ethics and Values in Social Work. Practical social work series. 5th Edition. 2020. Red Globe Press, UK.

Mode of assessment: Assignment, Mid-semester and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Educational Tour**	**L**	**T**	**P**	**C**
EDTAG201		**0**	**0**	**0**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			
Educational tour to well-known institutions and organizations will be conducted in the break between IV & V Semester or VI & VII Semester					

Student READY							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
RAWAG401 VII Semester	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)	Project	0	0	0	20	None
VIII Semester	**Experiential Learning Programme: Module I** – Any 1 course from the basket						
AGMAG403	Production Technology for Bioagents and Biofertilizer	Project	0	0	0	10	RAWAG401
GPBAG408	Seed Production and Technology	Project	0	0	0	10	RAWAG401
PATAG405	Mushroom Cultivation Technology	Project	0	0	0	10	RAWAG401

SACAG404	Soil, Plant, Water and Seed Testing	Project	0	0	0	10	RAWAG401
AENAG404	Commercial Beekeeping	Project	0	0	0	10	RAWAG401
AMPAG402	Poultry Production Technology	Project	0	0	0	10	RAWAG401
ENSAG402	Regenerative Agriculture	Project	0	0	0	10	RAWAG401
AENAG405	Entomoremediation	Project	0	0	0	10	RAWAG401
AGMAG404	Bioremediation	Project	0	0	0	10	RAWAG401
BICAG402	Metabolites Production Technology from Medicinal Plants	Project	0	0	0	10	RAWAG401
VIII Semester	**Experiential Learning Programme: Module II** – Any 1 course from the basket						
HORAG409	Commercial Horticulture	Project	0	0	0	10	RAWAG401
HORAG410	Floriculture and Landscaping	Project	0	0	0	10	RAWAG401
FSNAG403	Food Processing	Project	0	0	0	10	RAWAG401
AGMAG405	Agriculture Waste Management	Project	0	0	0	10	RAWAG401
AGRAG413	Organic Production Technology	Project	0	0	0	10	RAWAG401
AENAG406	Commercial Sericulture	Project	0	0	0	10	RAWAG401
ENSAG403	Phytoremediation	Project	0	0	0	10	RAWAG401
AGRAG414	Sustainable Smart Agriculture	Project	0	0	0	10	RAWAG401
AGMAG406	Microbial Metabolites – Production and Application	Project	0	0	0	10	RAWAG401
AEXAG406	Value Addition of Traditional Knowledge in Agriculture	Project	0	0	0	10	RAWAG401

Course code	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA)		L	T	P	C
RAWAG401		**Syllabus version**	**0**	**0**	**0**	**20**
Pre-requisite	None	1.0				

Course Objectives: The course is aimed at

1. Imparting real time agricultural education at the farmers' fields
2. Educating the students on the role of Universities, Research Stations, Agricultural Departments, Krishi Vigyan Kendras, Plant Clinics in benefitting the farmers
3. Offering, Agro-Industrial attachment programme to educate on its functions

Expected Course Outcome: At the end of the course the student should be able to

1. Appreciate the importance of undergoing rural agricultural education
2. Recommend and solve farmers problems faced during crop production
3. Comprehend and know how technology gets transferred from lab to land
4. Advise farmers to undergo soil and water testing and apply recommended dose of fertilizers and grow suitable crops based on their farm's soil and water health
5. Manage an agro-industry
6. Prepare and present agricultural reports

Criteria	Activities	No. of weeks	Credit Hours
a.	General orientation & On campus training by different faculties	**1**	**14**
b.	Village attachment	**8**	
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	**5**	
c.	Plant clinic	**2**	**02**
	Agro-Industrial Attachment	**3**	**04**
d.	Project Report Preparation, Presentation and Evaluation	**1**	
Total weeks and credits for RAWE & AIA		**20**	**20**

Agro- Industrial Attachment: The students would be attached with the agro-industries for a period of **3 weeks** to get an experience of the industrial environment and working**.**

RAWE Component-I : Village Attachment Training Programme

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE Component –II : Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post-harvest-processing, value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on trainings under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

Evaluation of Experiential Learning Programmes		
S. No.	**Parameters**	**Max. Marks**
1	Project Planning and Writing	10
2	Presentation	10
3	Regularity	10
4	Monthly Assessment	10
5	Output delivery	10
6	Technical Skill Development	10
7	Entrepreneurship Skills	10
8	Business networking skills	10
9	Report Writing Skills	10
10	Final Presentation	10
TOTAL		**100**

Course code	**Production Technology for Bioagents and Biofertilizer**	**L**	**T**	**P**	**C**
AGMAG403	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Providing insight into bioagents, biofertilizers and biopesticides
2. Developing skills for production of bioagents, biofertilizers and biopesticides
3. Motivating students to become entrepreneurs

Expected Course Outcome: At the end of the course the student should be able to

1. Identify commercially important bioagents and biofertilizers for mass production
2. Isolate and culture biofertilizers
3. Culture bioagents
4. Commercially produce biofertilizers suitable for varied environments
5. Culture bioagents and biopesticides and mass produce them
6. Follow the steps involved in quality control of bioagents and biofertilizers

Project Guidelines	**400 hours**
1. Types and importance of biofertilizers, biopesticides and bioagents in agriculture and organic farming systems.	

2.	Classification of biofertilizers used in biofertilizers production. Preparation of media used for isolation and culturing of biofertilizers: Jensen's agar, NFb medium, Yeast extract manitol agar, BGA-medium and Pikovaskaya's medium.
3.	Isolation of Rhizobium from root nodules; Isolation of Azotobacter from rhizosphere of cereal crops, Beijernickia, Acetobacter from soil, Azospirillium from roots of graminaceous plants, BGA from soil, Mycorrhizae from the roots, Phosphate solubilizing and Sulphur oxidizing microorganisms, ion chealators, potash mobilizers, organic matter decomposers and their isolation in pure culture form.
4.	Production of commercial biofertilizers Rhizobium, Azotobacter, Azospirillum and Acetobacter: selection of efficient strains, carriers and their sterilization, mother culture preparation, mass multiplication using shake culture method, mixing of culture and carriers and preparation of packets. Production of carrier based and grain based phosphate solubilizing biofertilizers.
5.	Methods of mass multiplication of BGA and Azolla. A large scale production of decomposting cultures. VAM : growth on Guinea grass roots and observations for root colonization. Preparation of VAM inoculum. Methods of application of Rhizobium, Azotobacter, Azospirillum and phosphate solubilizing biofertilizers. Methods of application of Azolla and blue green algal biofertilizers in paddy farming. Production of compost cultures.
6.	ISI standards. Estimating the viable bacterial count in carrier based biofertilizers. Storage of biofertilizer packets. Preparation of plan of biofertilizer production unit and proposal of loan.
7.	Mass production of Trichogramma, Cryptolaemus, Crysoperla.
8.	Mass production of HaNPV and EPN.
9.	Importance of Verticillium, Beauveria, Metarhizium, Nomuraea, Paecilomyces, *Hirsutella lthompsoni*, Trichoderma, Pseudomonas, Bacillus and organic matter decomposers. Testing of quality parameters and standardization of biopesticides.
10.	Visit to certified biocontrol and biofertilizer production units

Reference Books

1. Giri, B., Prasad, R., Wu, Q.S. and A. Varma. 2019. Biofertilizers for Sustainable Agriculture and Environment. Springer International Publishing, Germany.
2. Md. Arshad Anwer. Biopesticides and Bioagents: Novel Tools for Pest Management. 2017. Apple Academic Press, USA.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Seed Production and Technology**		**L**	**T**	**P**	**C**
GPBAG408		**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite		1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)					

Course Objectives: The course is aimed at

1. Demonstrating the basic principles involved in seed production technology
2. Imparting knowledge on seed health testing and cultivar identification
3. Extending knowledge on all aspects of controlling seed quality in the field

Expected Course Outcome: At the end of the course the student should be able to	
1. Realize the biology and analyse physical and chemical properties of varied forms of crop seeds 2. Recognize seed-borne pathogens and adapt appropriate control measures 3. Identify cultivars and undergo genetic purity testing 4. Comprehend seed certification standards 5. Inspect seed production fields 6. Market certified seeds and comprehend updates in seed production technology	
Project Guidelines	**400 hours**
1.	Floral biology of monocots and dicots. Types of monocot and dicot embryos. External and internal structures of monocot and dicot seeds. Seed coat structure, preparation of seed albums and identification.
2.	Proximate analysis of chemical composition of seed. Kinetics of seed imbibition and solute leakage. Seed invigoration and priming treatments. Accelerated ageing and controlled deterioration tests. Enzymatic activities and respiration during germination and effect of accelerated ageing. Identification and handling of instruments used in seed testing laboratory. Physical purity analysis of samples of different crops. Estimation of seed moisture content-oven method. Seed dormancy breaking methods
3.	Requirements for conducting germination test, specifications and proper use of different substrata for germination. Seed germination testing in different agri-horticultural crops. Seedling evaluation. Vigour and viability testing methods. Tetrazolium test in different crops. Seed and seedling vigour tests applicable in various crops.
4.	Economic importance of seed pathology in seed industry and plant quarantine, terminologies, important seed transmitted pathogens, seed microbes and their mode of action. Detection techniques and identification of common seed borne pathogens and quantification of infection percentage. Detection of seed borne fungi, bacteria and viruses. Identification of storage fungi, control of seed borne diseases and seed treatment methods. Seed health testing for designated diseases-blotter, agar and embryo count methods. Testing coated/pelleted seeds.
5.	Species and cultivar identification. Genetic purity testing by chemical, biochemical and molecular methods.
6.	Certification standards for self and cross pollinated and vegetatively propagated crops. Planning and management of different classes of seeds for self and cross pollinated crops.
7.	General procedure of seed certification. Identification of weed and other crop seeds as per specific crops. Field inspection at different stages of a crop and observations recorded on contaminants and reporting of results. Inspection and sampling at harvesting/threshing, processing and after processing for seed law enforcement. Testing physical purity, germination and moisture. Specifications for tags and labels to be used for certification purpose. Grow-out tests for pre and post-harvest quality control. Visits to regulatory seed testing laboratory, including plant quarantine lab and seed certification agency.
8.	Planning of seed production, requirements for different classes of seeds in field crops-unit area and rate. Seed production in cross pollinated crops with special reference to land, isolation, planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony. Supplementary pollination, pollen storage, hand emasculation and pollination in cotton, detasseling in corn and identification of rogues and pollen shedders. Pollen collection, storage, viability and

	stigma receptivity. Gametocide application and visits to seed production plots.
9.	Importance and promotion of quality seed, formal and informal seed supply systems. Basic concepts of marketing with special reference to seed. Importance and scope of seed industry in India, major constraints in seed industry, seed sector role of seed association, federation in seed trade, demand and supply of seed. Statutory requirements in seed business including research and development, estimation of cost of seed production, marketing costs and margins of seeds of different crops, case studies to compare public and private sectors in different conditions, impact analysis., seed pricing, cost benefit ratio and economic feasibility of seed industry.
10.	Lectures by industrial experts on global seed market-update, recent seed production technologies, seed production issues and food safety.

Reference Books

1. Khare, D and M.S. Bhale. Principles of Seed Technology. 2020. 2nd edition Scientific Publishers, New Delhi.
2. Agarwal, R.L. Seed Technology. 2018. 2nd edition. Oxford & IBH Publishing Co Pvt. Ltd, New Delhi, India.
3. Vanangamudi, K., S. Kavitha and K. Raja. A handbook of Seed Science and Technology. 2022. Agrobios, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Mushroom cultivation technology**	**L**	**T**	**P**	**C**
PATAG405	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Providing knowledge on commercial cultivation and marketing of mushrooms
2. Identifying cheaper recycled products to produce mushrooms
3. Demonstrating mushroom cultivation technology as a commercial business practice for farmers to ensure socio-economical and nutritional security and motivate students to become entrepreneurs.

Expected Course Outcome: At the end of the course the student should be able to

1. Identify edible, poisonous and medicinal mushrooms
2. Prepare media for pure culture of edible mushroom species and their long term preservation
3. Suggest mushroom farm layouts and substrates for cultivation
4. Demonstrate the cultivation practices for milky, oyster, button and paddy straw mushrooms
5. Manage pests and pathogens affecting mushrooms.
6. Market mushrooms profitably

Project Guidelines	**400 hours**
1.	Important mushrooms grown in India. Survey, identification, study of morphology and collection of edible mushrooms – button, oyster, paddy straw and milky mushrooms. Medicinal mushrooms-*Ganoderma.*

2.	Poisonous mushroom and mushroom poisoning, protoplasmic poisons, neurological effects, gastro-intestinal irritants and Disulfiram like constituents. Diagnostic biochemical methods for mushroom poisoning. Guidelines for avoiding poisonous mushrooms.
3.	Sterilization techniques – heat, moist heat, dry heat, radiation, filtration and chemical agents. Different culture media preparations. Preparation of media to isolate pure cultures of identified mushrooms. Isolation of edible fungi from the mushroom sporophore by tissue culture techniques. Preparation of mother spawn and bed spawn for oyster, paddy straw, button and milky mushrooms.
4.	Mushroom farm layout – mushroom sheds for oyster, paddy straw, button and milky mushrooms including spawn running room and cropping room. Preparation of different substrates – coir pith, compost, vermicompost, sorghum leaves, maize leaves to cultivate mushrooms.
5.	Paddy straw mushroom cultivation – raised bed method, hollow, cylindrical method, twisted rope method and modified cage method.
6.	Cultivation of oyster mushroom – bed cultivation, soil bed cultivation, log piece cultivation, container system of cultivation and harvesting.
7.	Cultivation of button mushroom – compost formulation and methods of composting; long and short term method; casing of compost, cropping and harvesting.
8.	Cultivation of milky mushroom **–** Pasteurization, Spawning and spawn running, casing and cropping.
9.	Pests, pathogens and their management –Sciarid flies, Phorids, Spring tails, mites, nematodes, bacterial and fungal diseases. Preparation of botanical extracts to control pest and diseases.
10.	Nutritional and calorific value of edible mushrooms. Preparation of recipes with oyster, paddy straw, button and milky mushrooms. Economics of mushroom cultivation and project preparation. Marketing strategies. Visit to mushroom farms.

Reference Books

1.	Kalač, Pavel. Edible Mushrooms: Chemical Composition and Nutritional Value. 2016. Academic Press, USA.
2.	*Tradd Cotter. Organic Mushroom Farming and Mycoremediation: Simple to Advanced and Experimental Techniques for Indoor and Outdoor Cultivation. 2015. Chelsea Green Publishing. USA.*
3.	*Dinesh Chandra, A. and D. Muralikrishnan. Medicinal Mushrooms: Recent Progress in Research and Development. 2019. Springer, Singapore.*

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Soil, Plant, Water and Seed Testing**	**L**	**T**	**P**	**C**
SACAG404	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Imparting knowledge on lab establishment for soil, plant, water and seed testing
2. Providing deeper understanding on nutrient application, its management and recommendations
3. Extending the practical knowledge on soil, plant, water and seed testing

Expected Course Outcome: At the end of the course the student should be able to

1. Plan and design a soil, plant, water and seed testing laboratory
2. Comprehend the working principles behind analytical instruments involved in testing samples
3. Analyze the nutrient status of soil samples and recommend judicious application of fertilizers
4. Analyze the nutrient status of plant samples
5. Determine the suitability of irrigation water
6. Comprehend the procedures involved in seed testing and certification

Project Guidelines	**400 hours**
1.	Establishment of soil, plant, water and seed testing lab-layout design, financial structure of soil, plant and water testing lab per annum, laboratory safety, quality control and standardization procedures.
2.	Analytical instruments, principles, calibration and applications -pH meter, EC meter, spectrophotometer, flame photometer and AAS.
3.	Sampling of soil - objectives, procedure and precautions. Determination of moisture content of soil. Determination of bulk and particle densities of soil. Determination of texture of soil - particle size analysis.
4.	Determination of soil microbial biomass carbon. Determination of biological activity of soil by dehydrogenase assay.
5.	Estimation of CEC and exchangeable sodium in soil. Standardization of solutions and reagents. Estimation of pH, EC, organic carbon, available N, P, K, S & micronutrients in soil. Use of soil testing kit for major and micronutrient analysis. Interpretation of analytical data - pH, EC, organic carbon, N, P, K, S and micronutrients: Fe, Mn, Zn, Cu, B and nutrient index. Fertilizer recommendation.
6.	Plant sampling and sample preparation for analysis-digestion of plant material. Sampling stages and plant part to be sampled. Estimation of N, P, K, S and micro nutrients: Fe, Mn, Zn, Cu and B from plant sample. Rapid plant tissue test for N, P, and K. Quantitative rating of plant analysis data and interpretation of results. Critical nutrient concentration and critical nutrient ranges.
7.	Determination of EC and pH of irrigation water. Determination of cations: Ca, Mg, Na and K of irrigation water. Determination of anions: CO_3, HCO_3 and Cl of irrigation water. Computation of SAR and RSC. Determination of COD and BOD of effluent water. Quality criteria, classification and suitability of irrigation water and water quality index
8.	Seed sampling and physical purity test; Germination and viability test; Seedling vigour test; Genetic purity test- grow out test and electrophoresis.
9.	Procedure of seed certification; Field inspection and preparation of field inspection report. Visit to seed production farms and seed processing plants.
10.	Lecture by industrial experts. Visit to soil, plant, water and seed testing laboratories.

Reference Books

1.	International Rules for Seed Testing. 2020. International Seed Testing Association-ISTA, Switzerland.
2.	Dhyan Singh, P.K. Chhonkar and B.S. Dwivedi. Manual On Soil, Plant And Water Analysis. 2015. Westville Publishing House. India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Commercial Beekeeping**	**L**	**T**	**P**	**C**
AENAG404	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Developing students as entrepreneurs of beekeeping
2. Enriching knowledge in apiary management
3. Providing information on producing best byproducts from honey

Expected Course Outcome: At the end of the course the student should be able to

1. Classify different bee species and identify the best species for cultivation
2. Procure apiary tools
3. Understand the biology of bees
4. Construct and manage bee colonies
5. Identify the pests and diseases of honey bee.
6. Prepare a bankable project on honey bee rearing and their byproducts

Project Guidelines	**400 hours**
1.	Different species of honey bees. Types of bee hives. Bee species suitable for farming.
2.	Bee keeping equipment and apiary tools.
3.	Caste system, biology of bees and life history. Jobs of worker bees, doings of a drone and queen bee. Swarming and communication among bees.
4.	Requirements of a colony, foraging, bee pasturage and flora. Factors influencing field activity.
5.	Placement of colonies, managing bee colonies, combining two colonies, dividing and multiplying colonies. Bee poisoning.
6.	Examining the colony, handling the queen, feeding the bees in a colony, manipulation of bees for honey production, extraction of honey, migratory beekeeping and seasonal management
7.	Larval diseases and diseases of worker bees. Pests and enemies of bee colonies
8.	Chemical composition of honey and their by-products. Role of FAO in quality assessment. Project preparation for bee keeping.
9.	Lecture by Industry experts.
10.	Visit to beekeeping units.

Reference Books

1. Abrol D.P. Beekeeping – A comprehensive guide to bees and beekeeping. 2019. Scientific Publishers, India.
2. Jayashree, K. V., C. S. Tharadevi and N. Arumugam. Apiculture. 2014. Saras Publication, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Poultry Production Technology**	**L**	**T**	**P**	**C**
AMPAG402	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Imparting knowledge on various aspects of poultry production and management
2. Interpreting the usage of scientific techniques and principles involved in rearing poultry
3. Stating the importance of healthy flock and furnishing skills on poultry product and by-product processing

Expected Course Outcome: At the end of the course the student should be able to

1. Comprehend the concepts of poultry rearing and realize the scope of poultry farming
2. Manage a hatchery
3. Supervise healthy and uniform flock of poultry
4. Sell by-products, utilize and dispose waste from a poultry farm
5. Recommend poultry business and marketing strategies
6. Understand the emerging trends and challenges in poultry industry

Project Guidelines	**400 hours**

Project

1.	Significance of poultry production. Poultry rearing–backyard system, semi-intensive system, intensive system: deep litter, slat system, wire floor, cage houses and raised platform cage houses. Cages; flat deck, Californian cages, “A” type cages, tier cages and furnished cages. Environmentally controlled houses, floor space, watering and feeding. Space requirements for different age groups and rearing conditions.
2.	Selection of site and location of poultry farm – importance of poultry housing and equipment. Feeder and drinker-pipeline, automatic drinker and nipple drinker arrangements. Principles of housing-location and basic principles of construction. Shed dimension measurement and area calculation, different shed designs and layout and poultry shed housing materials
3.	Hatchery: layout, design and location. Single and multistage incubators. Methods of incubation. Incubation periods. Physical factors and requirements for incubating eggs–temperature, humidity, gaseous environment, position and turning of eggs. Collection, selection, cleaning, sanitation and storage of hatching eggs. Setting, candling, transfer, hatching, pedigree hatching, chicks pull out, grading, packing and chick dispatch. In-ovo and in-hatch vaccinations and medications.
4.	Layer farm: System of layer farming, economic traits, pre-laying and laying management. Feeding types, layers in cages, Slat, Slat cum deep litter and deep litter houses – male and female management. Pre-peak, Peak and Post-peak laying period management, watering and lighting. Culling of unproductive birds, moulting, forced moulting, monitoring egg production curve and record keeping. Flock uniformity. Seasonal management of layer birds.
5.	Broiler farm: calculating FCR, EEF, CFCR, day gain, mean age and cost of production. Broiler production parameters. Breeder farm: brooding and growing, cost of production/ bird, cost of production Vs. egg returns, mortality %, livability %, FCR for eggs, HD %, HE %, HHHE %, HHE %, Egg mass, CPP, and visual control

	system (VCS). Maintaining poultry farms with healthy flocks and usage of biosecurity system.
6.	System of feeding: restricted and controlled, use of additives and non-additives, enzymes, probiotics, prebiotics and antibiotics, herbs and performance enhancers and utilization of non-conventional feedstuff. Organic chicken and lean meat production technology.
7.	Broiler duck production, management of broiler quail and goose. Disease management, processing and products.
8.	By-products. Egg formation, structure, quality, size, preservation, processing, grading and packaging. Poultry meat: chemical and nutritive value, composition, flavor, tenderness, meat processing, carcass yield and characteristics. Ready-to-Cook and Ready-to-Eat chicken. Waste utility: Design and layout of rendering plant. Manure and biogas generation from hatchery and slaughter house waste. Dead bird disposal and disposal of diseased birds. Bio-hazards of poultry waste.
9.	Poultry business, economics, marketing and prospects in India. Broiler performance indices. Food Laws and Regulations in Poultry Foods. Role of cooperative, public and private sectors in marketing. Improving processing, delivery systems and channels in marketing. Stock market, export and import in poultry sector.
10.	Heat resistant breeds to suit different climatic regions. Climatic factors affecting poultry production in housed conditions and their management. Weather forecasting. Visit to commercial poultry farms. Lecture by industrial experts on recent developments in poultry farming.

Reference Books

1.	Ensmiger. M. E., 2015. Poultry Science. 3rd Edition. CBS Publishers and Distributors, India.
2.	Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Regenerative Agriculture**		**L**	**T**	**P**	**C**
ENSAG402	**Syllabus version**		**0**	**0**	**0**	**10**
Pre-requisite	1.0					
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)					

Course Objectives:

1. Explain the practice of agro-ecology.
2. Summarize learning tools and techniques to enhance carbon sequestration and mitigate climate change.
3. Develop the undergraduate agricultural students to become consultants on the practice of regenerative agriculture.

Expected Course Outcome:

1. Understand the concepts of regenerative agriculture. 2. Design regenerative agriculture for varied settings. 3. Describe different regenerative techniques. 4. Correlate the parameters involved in assessment of regenerative agriculture. 5. Articulate the benefits of regenerative agriculture to the farmers. 6. Use the regenerative agricultural concepts in real world sites.	
Project Guidelines	**400 hours**
1.	Introduction-Evolution of the concept of regenerative agriculture; Core principles of regenerative agriculture; Allied agricultural practices; Relevance of regenerative agriculture to sustainable development goals; Scientific deliberations of proponents and opponents of regenerative agriculture.
2.	Designs-Perspectives of capital resources; Evaluation of biotic and abiotic factors of the study sites; Design Principles-zone and sector planning; Comprehensive regenerative customized designs for varied sites - Natural habitats in agricultural-urban backyards, peri-urban allotments or rural homesteading; Restructuring existing designs; Flexible designs for adaptive regenerative agricultural sites.
3.	Regeneration Techniques - Basic underlying patterns of natural phenomena; Regenerative soil practices - soil moisture retention strategies, role of soil adjuvants, soil vaccines, maintenance and enhancement of soil food web; Strategies for carbon sequestration -agro-biodiversity - land use diversification, polycultures and perennial cropping strategies, high field border density, living fences, hedgerows, zero or minimal tilling, multi-species cover crops, diverse crop rotation, strip-intercropping, wind breaks, silvopasture, multi-strata agro-forestry; regenerative grazing management - adaptive multi-paddock (AMP) grazing, rotational grazing; Tools to monitor carbon sequestrations; measures for water collection, Water retention basin with waterproofing, integrated water management systems, Riparian buffers and water breaks; Forests garden; Food Sheds; Livestock integration; Fodder banks; Outdoor living barns; Adaptive management techniques for resources cycling, community dynamics, increasing trophic networks and habitat diversity, self-regulating measures; Innovative practices for decision-making under uncertainty; Ecological infrastructures to increase ecological resilience; Global indigenous regenerative systems and practices.
4.	Indicators of Regenerative Agriculture - Evaluation of indicators for social and economic equity, food security, conservation of biodiversity, and provision of ecosystem services gains and reductions in resource consumption; Economic resilience, viability of farming community; Regenerative enterprise ecosystem; Regenerative producer web; Appraisal of multi-capital flows and investments; Bottlenecks in evaluation criteria
5.	Dissemination of regenerative agriculture to farmers - Strategies adopted to make regenerative agriculture as an eco-movement; Regenerative agriculture in India - Case studies
6.	Quality Assessment - relevance; Components - baseline requirements, documentation of compliance of soil health, land management, carbon sequestration, animal welfare, labor worker fairness; Supply chain guidelines; International and National agencies involved; Issues in certifications.
7.	Learn by observing - Field visits to experience regenerative agricultural practices in different farming systems
8.	Discussions with practitioners of regenerative agriculture
9.	Learn by doing – Hands-on implementation of concepts of regenerative agriculture
10.	Pilot plot studies in VIT farm/community project

Reference Books and Materials	
1.	David Dent and Boris Boincean (Editors). Regenerative Agriculture - What's Missing? What Do We Still Need to Know? 2021. Springer Nature, Switzerland AG.
2.	Eric Toensmeier. 2016. The Carbon Farming Solution: A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security. Chelsea Green Publishing, Vermount, USA.
3.	Allan Savory and Jody Butterfield. 2016. Holistic Management – A Commonsense Revolution to Restore Our Environment (Third Edition), Island Press, Washington,DC
Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation	

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Entomoremediation**	**L**	**T**	**P**	**C**
AENAG405	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Identification and mass production of insects involved in entomoremediation
2. Enriching knowledge on utilization of insects to degrade waste materials
3. Providing information on producing best byproducts such as livestock feed

Expected Course Outcome: At the end of the course the student should be able to

1. Identify and mass produce insects that can be used in biomass management.
2. Identify and mass produce insects that can accumulate heavy metals.
3. Identify and mass produce insects that can help in degradation of plastics.
4. Practice novel techniques for mass multiplication of insects at low cost.
5. Evaluate the nutritional and anti-nutritional parameters of the insects.
6. Develop promising products such as poultry or fish feed.

Project Guidelines	**400 hours**
1.	Identification of major insects commonly being used in biomass management.
2.	Identification of major insects commonly being used in heavy metals degradation.
3.	Identification of major insects commonly being used in plastic degradation.
4.	Mass multiplication of Black soldier fly, *Hermetia ilucens* using biowastes.
5.	Mass multiplication of wax moth, *Galleria mellonella* using different substrates.
6.	Mass multiplication of meal worm, *Tenebrio mollitor* using different substrates.
7.	Experiments on analysing the nutritional and anti-nutritional parameters.
8.	Development of various products benefitting the farmers and society.
9.	Lecture by Industry experts.
10.	Visit to insect rearing units.

Reference Books	
1.	A. Rakshit, M.Parihar, B.Sarkar, H. B. Singh and L. F. Fraceto. Bioremediation Science From Theory to Practice. 2021. CRC Press, USA.
2.	A. van Huis and J.K. Tomberlin. Insects as food and feed: from production to consumption. 2017. Wageningen Academic Publishers, Netherlands.
Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly	

Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Bio-remediation**	**L**	**T**	**P**	**C**
AENAG405	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Imparting knowledge on importance of microbes in bioremediation of polluted area
2. Describing the physiology Of the microbes and their metabolism
3. Explaining morphology, vegetative, reproductive structures and resting structures of fungi, bacteria and other microbes used in bioremediation.

Expected Course Outcome: At the end of the course the student should be able to

1. Recognize the importance and scope of bioremediation and analyze the causes and factors leading to remediation pathway.
2. Classify microbes taxonomically for designing effective remediation strategies.
3. Differentiate microbes based on morphology, vegetative, reproductive and resting structures.
4. Relate metabolic pathway, cycles, physiology of microbes.
5. Describe physiology of microbes and the strategies for bioremediation.
6. Practice the remediation strategies with different microbes

Project Guidelines		**400 hours**
1.	Microbes for bioremediation- Essential characteristics of microbes for bioremediation, Microbial adaptation for adverse conditions, Microbes involved in bioremediation, Metabolic process involved in bioremediation,	
2.	Bacteria versus fungi for bioremediation, Microbial interaction for bioremediation optimizations. Factors affecting bioremediation, Bioremediation mechanisms and limitations.	
3.	Bioremediation techniques-*In situ* remediation techniques, *Ex situ* techniques, Characterization of essential factors for bioremediation,	
4.	strategies for the improvement of bioremediation techniques, physical parameters, chemical parameters, biological parameters,	
5.	Molecular techniques in the analysis of contaminated sites and Successful bioremediation projects	
6.	Bioremediation of contaminants-Organic wastes, Nature of organic compounds, Decomposition of organic matter, Mineralization and Immobilization, Microbes involved in decomposition, Anaerobic decomposition of organic matter, Humus, Lignin,	
7.	Environmental impact of fertilizers and Treatment of domestic sewage, Bioremediation of inorganic compounds and mixed contaminants, Phytoremediation of contaminants.	
8.	Effluents and sewage analyses-Introduction, Sample preparation, Physical characteristics, Chemical characteristics/constituents, Organic constituents and Inorganic constituents. Bacterial growth and metabolism.	
9.	Microbes in Extreme Environment – Special features of the thermophilic,	

	methanogenic and halophilic archaea; Photosynthetic bacteria, Cyanobacteria; microbes in other extreme conditions – deep ocean, and space. Microbial Techniques in isolation, culturing , detection and staining
10.	Microbial analysis of water, waste water and soil Introduction, Microbiological equipment's, Basic requirements of microorganism, Bacterial growth, Characteristics of microorganism and Its safety measures. Microbial communities in natural water determining sanitary quality of water: bacteriological evidence of faecal pollution. Water pollution: causes hazards & control of human water borne diseases. 1. Water purification methods. 2.Disinfection of potable water supplies
Reference Books	
1.	A.G Murugesan and C Rajakumari. Environmental science and biotechnology Theory and techniques. 2019. MJP Publishers, India.
2.	P Rajendran and P Gunasekaran. Microbial Bioremediation 2019. MJP Publishers, India.
Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation	
Recommended by Board of Studies	28-02-2024
Approved by Academic Council	No.73 **Date** 14-03-2024

Course code	**Metabolite Production Technology from Medicinal Plants**	**L**	**T**	**P**	**C**
BICAG402	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				
Course Objectives: The course is aimed at					
1. Providing insight into Extraction and production technology of metabolites from medicinal plants 2. Developing skills for scale up and commercial production of extracted 3. Motivating students to become entrepreneurs					
Expected Course Outcome: At the end of the course the student should be able to					
1. Identify commercially important extracted metabolites from medicinal plants 2. Isolate metabolites 3. Scale up metabolites 4. Commercially produce the metabolites suitable for varied environments 5. Cultue medicinal plants for the production of therapeutically significant metabolites 6. Follow on quality control of therapeutic agents and scaling up of metabolites					
Project Guidelines	**400 hours**				
1.	Types and importance of different kind of medicinal plants for production of the production of therapeutically significant metabolites.				
2.	Classification of different kind of medicinal plants. Culturing of medicinal plants.				
3.	Extraction techniques of metabolites - Ethanol, phenol extraction from plants				
4.	Selection of efficient strains, mixing of culture and carriers - Production of carrier based				
5.	Analytical techniques for Identification and characterization of the metabolites –				

	HPLC, GCMS, SEM, TEM, chromatography
6.	Scaling up techniques for the isolated metabolites
7.	ISI standards. Storage techniques
8.	Preparation of plan for the production unit and proposal of loan.
9.	Mass production & Testing of quality parameters and standardization
10.	Visit to certified production units

Reference Books

1. Bird. C. The Fundamentals of Horticulture: Theory and Practice. 2014. Royal Horticultural Society, Cambridge University Press, London.
2. Jitendra Singh. Basic Horticulture. 2020. Kalyani Publishers. New Delhi.
3. Adams, C., Early M., J. Brook and K Bamford. Principles Of Horticulture: Level 2. 2014. 7th Revised Edition., Taylor and Francis, London, UK.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Commercial Horticulture**	**L**	**T**	**P**	**C**
HORAG409	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Imparting knowledge on propagation of commercial horticultural crops
2. Demonstrating business opportunities based on the advances in the field of horticulture
3. Describing processing, marketing and commercialization of horticultural products

Expected Course Outcome: At the end of the course the student should be able to

1. Understand propagation, and post-harvest handling of fruits
2. Understand nursery production and marketing of ornamentals
3. Should be able to cultivate vegetables under protected cultivation
4. Should be able to cultivate flowers under protected cultivation
5. Plan and execute processing and marketing of horticultural crops
6. Comprehend and follow the current advances in horticulture and exploit the techniques

Project Guidelines	**400 hours**
1.	Propagation of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants and plant certification. Postharvest handling, value addition, packaging, marketing and quality control.
2.	Nursery production of ornamentals: Production of plantlets, production of potted plants, management, maintenance, sale and marketing.
3.	Protected cultivation of vegetables: Nursery raising, procurement, transplanting, management and maintenance of the crop; Postharvest handling and value addition, quality control and marketing.
4.	Protected cultivation of flowers: Nursery raising, procurement, transplanting, management and maintenance of the crop; Postharvest handling, quality control and marketing.

5.	Planning and execution of a market survey, preparation of processing schedule, preparation of project module based on market information.
6.	Calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects.
7.	Identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale. Packaging, labelling, pricing and marketing of horticultural products. Current trends, opportunities and constraints in the export market. IPR in horticulture.
8.	Advances in micropropagation of horticultural crops and their management. Present status, problems and future potential of medicinal and aromatic plants.
9.	Advances in commercial landscape designing, designing of kitchen and rooftop gardens. Organic farming. Survey of commercial horticultural products.
10.	Lecture by industrial experts on recent advances in commercializing horticulture. Visit to advanced commercial horticultural farms.

Reference Books

1.	Amit Deogirikar. A Text Book on Protected Cultivation and Secondary Agriculture. 2019. Rajlaxmi Prakashan, Aurangabad, India.
2.	Patel, N.L., S.L. Chawla and T.R. Ahlawat. Commercial Horticulture. 2015. New India Publishing Agency, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Floriculture and Landscaping**	**L**	**T**	**P**	**C**
HORAG410	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Describing production technology and benefits of commercially important flowers
2. Imparting knowledge on designing landscapes
3. Teaching marketing strategies associated with floriculture and landscaping

Expected Course Outcome: At the end of the course the student should be able to

1. Understand the mechanism of flowering
2. Know to produce commercially important flowers
3. Exploit the uses of flowers based on market needs
4. Comprehend advanced techniques in floriculture.
5. Market flowers.
6. Design landscape architecture

Project Guidelines	**400 hours**
1.	Floral structure and value of commercially important flowers. Mechanism and factors controlling flowering.
2.	Requirements for commercial flower production - preparation of land and layout, propagation, production and management of commercial flowers. Harvesting and postharvest handling of produce.

3.	Bedding plants production for floriculture. Foliage plants or houseplants. Cut cultivated greens and cut flowers. Other flower crops.
4.	Dry flower production - identification of suitable species, drying, packaging and forwarding techniques. Arrangement and composition of flowers. Making of bouquets, button hole, wreath, veni and gajras, car and marriage palaces.
5.	Protected cultivation of commercially important flowers. Integrated nutrient, water, pest and disease management employed in floriculture. Micropropagation, hydroponics and its economic considerations.
6.	Marketing of produce, cost analysis, institutional management, visit to flower growing areas and export houses.
7.	Planning and designing, site analysis, selection and use of plant material for landscaping. Formal and informal garden, features, styles, principles and elements of landscaping. Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues.
8.	Selection and propagation of plants suitable for creating landscapes. Pot plant management.
9.	Making of lawns. Maintenance of Bonsai. Use of software in landscaping.
10.	Visits and attachment to commercial landscaping architectural firms

Reference Books

1.	Sing, A.K. and A Sisodia. Text Book of Floriculture and Landscaping. 2017. New Publishing agency, India.
2.	Prasad, S., D. Singh and U. Kumar. Commercial Floriculture. 2019. 2nd edition. Agrobios, India.
3.	Tim W. The fundamentals of Landscape Architecture. 2015. 2nd revised edition. Fairchild Books. United Kingdom.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Food processing**	**L**	**T**	**P**	**C**
FSNAG403	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Developing analytical and entrepreneurial skills in food processing
2. Providing hands on experience in processing food products
3. Describing business strategies involved in running a food processing industry

Expected Course Outcome: At the end of the course the student should be able to

1. Analyse the marketability of a food product
2. Realize the potential of food processing
3. Comprehend project proposals of a food processing industry
4. Prepare a project proposal for running a value added food product industry
5. Understand sales strategies of a food processing industry
6. Should be able to manage and initiate a food product enterprise

Project Guidelines	**400 hours**

1.	Identification of the product to be manufactured, market survey, analysis of the existing status of the identified product and targeted market and customer.
2.	Processing of fruits, preparation of pulp, juices, RTS, squash and nectars from the seasonal fruits. Preparation of project proposal with supply chain of inputs, personnel plan, production plan and finance plan. Processed fruit products. Innovativeness and creativity. Quality assessment. Maintenance of production records.
3.	Processing of seasonal vegetables for sauces and ketchup. Preparation of project proposal with supply chain of inputs, personnel plan, production plan and finance plan. Processed vegetable products. Innovativeness and creativity. Quality assessment. Maintenance of production records.
4.	Processing of value added products. Preparation of jam, jelly and marmalade. Preparation of the project proposal with supply chain of inputs, personnel plan, production plan and finance plan. Value added products. Innovativeness and Creativity. Quality assessment. Maintenance of production records.
5.	Processing of bakery products. Preparation of bread, biscuit and cookies. Preparation of project proposal with supply chain of inputs, personnel plan, production plan and finance plan. Bakery products. Innovativeness and Creativity. Quality assessment. Maintenance of production records.
6.	Processing of milk, poultry and meat products. Preparation of project proposal with supply chain of inputs, personnel plan, production plan and finance plan. Value added products. Innovativeness and Creativity. Quality assessment. Maintenance of production records.
7.	Sales strategy, assessment of sales performance and payback period.
8.	Detailed project report on setting up of enterprise in the selected areas of product manufacture and evaluation.
9.	Lecture by industrial experts on food processing, testing, quality, safety and standards, regulations and nutritional quality assessment.
10.	Visit to food processing industries.

Reference Books

1.	Fellows, P.J. Food Processing Technology: Principles and Practice. 2016. 4th edition. Woodhead Publishing. UK.
2.	Jagadish Chandra Jana., Tanmay Kumar Koley., Arghya Mani., Chandan Karak., Dipak Kumar Murmu. 2018. Advances in post harvest management, processing and value addition of horticultural crops-Part 2: Vegetables, spices and plantation crops. Today and Tomorrow's Printers and Publishers, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Agriculture Waste Management**	**L**	**T**	**P**	**C**
AGMAG405	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Imparting knowledge on recycling and management of different agricultural waste 2. Demonstrating integrated agricultural waste management 3. Sharing knowledge on methods of conversion of waste into farm inputs	
Expected Course Outcome: At the end of the course the student should be able to	
1. Gain knowledge on agricultural wastes and utilize techniques to convert waste to inputs 2. Practice varied composting techniques of agricultural waste 3. Recommend processes to recycle agricultural wastes 4. Manage and utilize animal waste 5. Comprehend management of waste from food processing industries 6. Understand sludge and waste water treatment and its applications	
Project Guidelines	**400 hours**
1.	Agricultural wastes: Solid, liquid and gaseous wastes from field, livestock and agro-industries.
2.	Aerobic waste treatment: Activated sludge, rotatory drum, aerated lagoons and fluidized bed reactor. Visit to an aerobic treatment plant.
3.	Anaerobic waste treatment: hydrolysis, acidogenesis, acetogenesis, methanogenesis and anaerobic lagoons. Visit to an anaerobic treatment plant.
4.	Composting: pit method, heap method. Compostable and uncompostable inputs. Coir composting.
5.	Vermicomposting: Earth worms that can be effectively used for converting compost to soil conditioners. Production of vermicompost and vermicasts. Integrating composting and vermicomposting.
6.	Bioremediation. Biofuel production from waste including biodiesel and bioethanol. Mushroom cultivation and biofertilizer preparation **using farm residues.** Integrated waste treatment with algal cultivation. **Pulp and paper production from plant waste.**
7.	Silage making: converting green fodder into silages, forages that can be used, fermentation, hylage and silage effluent treatments.
8.	Animal husbandry and poultry wastes: manure, biogas, fish feed, leather and nutrients from bones.
9.	Food processing waste: management of dairy processing, fruits and vegetable processing and oil and fat processing wastes.
10.	Municipal and industrial sludge management. Wastewater application systems.
Reference Books	
1.	Camille N. Foster. **Agricultural Wastes: Characteristics, Types and Management (Waste and Waste Management).** 2015. Nova Science Publishers Inc. UK.
2.	Zainul Akmar Zakaria. Sustainable Technologies for the Management of Agricultural Wastes. 2018. Springer, Singapore.
Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation	

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Organic Production Technology**	**L**	**T**	**P**	**C**
AGRAG413	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment				

	(RAWE&AIA)
Course Objectives: The course is aimed at	
1. Imparting knowledge on indigenous and scientific techniques of organic farming 2. Demonstrating integrated organic farming 3. Sharing knowledge on certification and marketing of organic produce	
Expected Course Outcome: At the end of the course the student should be able to	
1. Comprehend the principles and components of organic farming 2. Practice biological soil enrichment 3. Produce biological plant nutrient mixtures 4. Recommend indigenous pest and disease management practices 5. Manage an integrated organic farm 6. Market and utilize products and by-products of an profitable organic farm	
Project Guidelines	**400 hours**
1.	Organic farming: Importance, scope, principles, perspectives and concepts. Components of organic production of agricultural and horticultural crops. Organic ecosystems. Organic farms visit to study the various components and their utilization
2.	Soil biological approaches for sustainable agriculture: Crop rotation, mixed cropping, mulching, soil solarization and raising green manure crops.
3.	Bio-inoculants: Production and use of BGA, Azolla, Rhizobium, Azotobacter, Azospirillum, phosphate solubilizing bacteria and vesicular arbuscular mycorrhiza.
4.	Indigenous technology knowledge for nutrient and weed management. Production and uses of Panchagavya and Dasagavya.
5.	Mass multiplication of Trichoderma and Pseudomonas to control important soil borne diseases. Biopesticides, pheromones, plant medicinal extracts as insect repellents, trap crops, bird perches, setting of light traps and practice of traditional methods to control insect pests and diseases.
6.	Practice integrated organic farming: farm design, land preparation, raising suitable agricultural crops, horticultural crops, medicinal and aromatic plants, forage crops, tree species according to the soil type, and production of livestock and birds. Integrated nutrient, pest, disease and weed management.
7.	Post-harvest management. Grading, packaging and handling.
8.	Residue management: Mushroom cultivation, farmyard manure, Composting, coir composting, vermicomposting, biogas production and green manuring.
9.	Working out the cost: benefit ratio and comparing the ratio between organically and inorganically grown crops.
10.	Operational structure of National Programme for Organic Production (NPOP). Minimum Pre-requisites as NPOP. Importance of AGMARK in organic production. Quality considerations, certification of organic products, labelling, accreditation, marketing and export potential of organic products.
Reference Books	
1.	Reddy. S.R. Principles of organic farming. 2017. Kalyani publishers, India
2.	Sarath Chandran, Unni M.R and Sabu Thomas. Organic farming. 2018. Woodhead Publishing, UK.
3.	Palaniappan, S.P. and Annadurai, K., Organic Farming Theory & Practice. 2018. Scientific publishers, India.
Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation	
Recommended by Board of Studies	28-02-2024

Approved by Academic Council	No.73	Date	14-03-2024

Course code	Commercial Sericulture	L	T	P	C
AENAG406	Syllabus version	0	0	0	10
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Providing practical experience in silkworm rearing
2. Imparting knowledge in mulberry cultivation
3. Demonstrating production of silk

Expected Course Outcome: At the end of the course the student should be able to

1. Practice production of mulberry
2. Procure and rear silkworms.
3. Design and manage a Chawki garden
4. Manufacture good quality silk
5. Manage pest and diseases affecting silkworms.
6. Project sericulture farming as a profitable business

Project Guidelines		400 hours
1.	Mulberry: Area, distribution, popular varieties, climatic and soil requirements. Nursery – Selection of planting material, bed preparation, planting, propagation and management.	
2.	Mulberry main field preparation: Manuring, Planting, Irrigation and Weeding. Intercropping, training and pruning. Shoot harvest, pruning transportation and preservation. Farm machinery implements.	
3.	Authorized silkworm races: crossbreeds and bivoltine. Rearing house planning and maintenance. Disinfestation of rearing appliances. Agencies involved in egg production. Procurement, transportation, preservation, incubation, black boxing and hatching. Rearing of chawki worms.	
4.	Chawki garden maintenance and management. Late age rearing. Moulting care, spinning care and harvesting. Calculation of effective rate of rearing. Transporting and marketing of cocoons. Visit to chawki rearing units.	
5.	Physical and commercial properties of silk and cocoon. Cocoon sorting. Silk reeling, re-reeling, skein preparation and packing. Eri silk spinning and methods. Sampling and testing procedure for winding, size, strength test condition cohesion and seriplane test. Standards for grading raw silk. Visit to silk reeling units.	
6.	Bacterial and fungal diseases of silkworm. Predators of silkworm.	
7.	Economics of mulberry production and management. Economics of rearing silkworms.	
8.	Project preparation for establishing late age rearing centres.	
9.	Large scale sericulture farming and contract farming.	
10.	Lecture by industrial experts and visits to cocoon markets.	

Reference Books

1.	Sehgal, P.K. Text book of sericulture, apiculture and entomology. 2017. Kalyani Publishers, India.
2.	Charles Valentine Riley. The Mulberry Silk-Worm: Being a Manual of Instructions in Silk Culture, Classic Reprint. 2018. Forgotten Books, UK.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly

Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Phytoremediation**	**L**	**T**	**P**	**C**
ENSAG403	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Imparting knowledge on the significance of phytoremediation of polluted area.
2. Describing the physiology of the crops and their metabolism
3. Explaining the morphology, vegetative, reproductive structures and taxonomy of different plants in different families which is used in phytoremediation.

Expected Course Outcome: At the end of the course the student should be able to

1. Recognize the importance and scope of phytoremediation and analyze the causes and factors leading to remediation pathway.
2. Classify plants taxonomically for designing effective remediation strategies.
3. Differentiate plants based on morphology, vegetative and reproductive characteristics.
4. Relate the metabolic pathway based on cycles and crop physiology.
5. Describe the crop physiology and the strategies for phytoremediation.
6. Practice the remediation strategies with different plants.

Project Guidelines		**400 hours**
1.	Plants for phyto remediation- Essential characteristics of plants for phytoremediation, plants adaptation for adverse conditions, plants involved in phytoremediation, Metabolic process involved in phytoremediation,	
2.	*Gramineae and Leguminosae* plants for phytoremediation, crops and microbial interaction for rhizo-remediation optimizations. Factors affecting phytoremediation, phytoremediation mechanisms and limitations.	
3.	phytoremediation techniques-*In situ* remediation techniques, *Ex situ* techniques, Characterization of essential factors for phytoremediation,	
4.	strategies for the improvement of phytoremediation techniques, physical parameters, chemical parameters, biological parameters,	
5.	Molecular techniques in the analysis of contaminated sites and Successful phytoremediation projects	
6.	phytoremediation of contaminants-Organic wastes, Nature of organic compounds, Decomposition of organic matter, Mineralization and Immobilization, Microbes involved in decomposition, Anaerobic decomposition of organic matter, Humus, Lignin in interaction with plants.	
7.	Environmental impact of fertilizers and Treatment of domestic sewage with phytoremediation.	
8.	phytoemediation of inorganic compounds and mixed contaminants, Phytoremediation of contaminants	
9.	Studies on phytoremediation techniques with different crop - Cereals like ragi, jowar, cumbu -Pulses like black gram and green gram – tree crops like Casuarina and teak involved in phytoremediation	

10.	Microbial Techniques in isolation, culturing, detection and staining of microbes involved in rhizoremediation associated with phytoremediation

Reference Books

1.	Phytoremediation: Management of Environmental Contaminants, Volume 1- Guy R. Lanza, Lee Newman, Sarvajeet Singh Gill, Ritu Gill, Abid A. Ansari. 2015. Springer Publications, Netherlands.
2.	Microbial Bioremediation By P Rajendran and P Gunasekaran. 2019. MJP Publishers, India.
3.	A.G Murugesan and C Rajakumari. Environmental science and biotechnology Theory and techniques. 2019. MJP Publishers, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Sustainable Smart Agriculture**	**L**	**T**	**P**	**C**
AGRAG414	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Explain the process and practice of precision agriculture.
2. Impart the knowledge on different tools and techniques used in precision agriculture.
3. Develop the skills needed for agricultural students to pursue their career in precision agriculture.

Expected Course Outcome:

1. Understand the concepts of precision agriculture.
2. Define the role of remote sensing and GIS in precision agriculture.
3. Describe various crop and soil related sensors used in precision agriculture.
4. Comprehend the importance of farm machineries in precision agriculture.
5. Elaborate on water conservation methods, renewable energy applications and water quality assessment.
6. Apply the concept of precision agriculture in real world situations.

Project Guidelines	**400 hours**
1.	Precision agriculture – Overview of technologies- challenges faced by farmers and strategies to implement precision agriculture – Advantages of precision agriculture over traditional agriculture- Precision agriculture data handling and management processes.
2.	Remote sensing, geographical information system (GIS) and global positioning system (GPS) - Components – Type of GPS- functions and usage of GPS. RS platforms-hardware and software - Data conversion -map coordinate systems- Data types and inputs -Raster based – multispectral, hyper spectral and thermal-Vector based data – point line and polyogn.Tasks completed in RS and GIS platform-image processing for various applications – spectral signatures- vegetative indices - uses and applications.
3.	Overview of different sensors used in precision agriculture- Soil – Crop and weather sensors – usage of IoT enabled sensors at field scale for various applications.

4.	Implementation of drones techniques in precision agriculture – fixed and rotary wing drones – planning of flight path ways – creating ground control points – image capturing – processing of data- real world applications.
5.	Usage of farm machineries in precision agriculture – tractor operated primary and secondary tillage implements – Sowing methods- nursery preparation for machine transplanting – walk type or ride type paddy transplanter-seed drill- harvest methods –economic benefits of various methods used – Cost of cultivation – cost benefit analysis.
6.	Irrigation methods- drip-sprinkler- water quality assessment – surface and ground water – tools and techniques – renewable energy application in agriculture- soil and water conservation methods – watershed management.
7.	Industry and field visits to experience precision agricultural practices.
8.	Discussions with industry experts of precision agriculture – application of drones – farm machineries – IoTs – irrigation methods.
9.	Hands on training with various soil and crop related sensors – usage of drones – software – hardware.
10.	Implementation of precision agriculture technology in VIT farm – Pilot plot studies.
Reference Book and Materials	
1.	D. Kent Shannon David E. Clay Newell R. Kitchen. Precision Agriculture Basics. 2020. ACSESS.USA.
2.	John Stafford. Precision agriculture for sustainability. 2018. Burleigh Dodds Science Publishing Limited, UK.
3.	Ruth Kerry and Alexandre Escola. Sensing Approaches for Precision Agriculture. 2021. Springer Nature, Switzerland.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Microbial Metabolites – Production and Application**	**L**	**T**	**P**	**C**
AGMAG406	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				

Course Objectives: The course is aimed at

1. Providing insight into Extraction and production technology of metabolites from seaweeds, fungi, bacteria, actinomycetes and PGPRs
2. Developing skills for scale up and commercial production of extracted metabolites like antibiotics, amino acids, auxins and gibberellins
3. Motivating students to become entrepreneurs

Expected Course Outcome: At the end of the course the student should be able to

1. Identify commercially important extracted metabolites for mass production
2. Isolate metabolites
3. Scale up metabolite production
4. Commercially produce the metabolites suitable for varied environments
5. Culture bioagents of therapeutic significance
6. Follow steps involved in quality control of bioagents

Project Guidelines		**400 hours**
1.	Types and importance of different kind of bioagents (seaweeds, fungi, bacteria, Actinomycetes, PGPRs) in agriculture and organic farming systems for production of the production of therapeutically significant metabolites like antibiotics, amino acids, auxins and gibberellins	
2.	Classification of different kind of bioagents production. Preparation of media used for isolation and culturing of bioagents: Jensen's agar, NFb medium, Yeast extract manitol agar, BGA-medium and Pikovaskaya's medium, PDA medium, Nutrient agar medium	
3.	Isolation techniques of bacteria, fungi, actinomycetes from root nodules, rhizosphere, phyllosphere,; Isolation techniques from rhizosphere of cereal crops, from soil, from roots of gramineous plants, BGA from soil, Mycorrhizae from the roots, Phosphate solubilizing and Sulphur oxidizing microorganisms, ion chelators, potash mobilizers, organic matter decomposers and their isolation in pure culture form.	
4.	Extraction techniques of metabolites - Ethanol, phenol extraction from mother culture, selection of efficient strains, carriers and their sterilization, mother culture preparation, mass multiplication using shake culture method, mixing of culture and carriers Production of carrier-based formulations	
5.	Analytical techniques for Identification and characterization of the metabolites – HPLC, GCMS, SEM, TEM, chromatography	
6.	Scaling up techniques for the isolated metabolites	
7.	ISI standards. Storage techniques	
8.	Preparation of plan for the production unit and proposal of loan.	
9.	Mass production & Testing of quality parameters and standardization	
10.	Visit to certified production units	
Reference Books		
1.	Giri, B., Prasad, R., Wu, Q.S. and A. Varma. Biofertilizers for Sustainable Agriculture and Environment. 2019. Springer International Publishing, Germany.	
2.	Md. Arshad Anwer. Biopesticides and Bioagents: Novel Tools for Pest Management. 2017. Apple Academic Press, USA.	
Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73	**Date** 14-03-2024

Course code	**Value Addition of Traditional Knowledge in Agriculture**	**L**	**T**	**P**	**C**
AEXAG406	**Syllabus version**	**0**	**0**	**0**	**10**
Pre-requisite	1.0				
RAWAG401	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE&AIA)				
Course Objectives: The course is aimed at					
1. Imparting knowledge on importance of documenting traditional knowledge and practices in Agriculture and Animal Husbandry 2. Documenting the traditional practices and knowledge in Agriculture and Animal Husbandry. 3. Validating the documented traditional knowledge and practices in Agriculture and					

Animal Husbandry and developing prototype model through entwining traditional knowledge with scientific knowledge

Expected Course Outcome: At the end of the course the student should be able to

1. Understand and comprehend the importance of documenting traditional knowledge and practices in agriculture
2. Understand and comprehend the importance of documenting traditional knowledge and practices in animal husbandry
3. Identify different traditional practices in agriculture
4. Identify different traditional practices in animal husbandry
5. Develop prototype models in agriculture
6. Develop prototype models in animal husbandry by entwining the traditional knowledge with scienctific knowledge

Project Guidelines		**400 hours**
1.	Documentation of traditional knowledge and practices in agriculture and animal husbandry- Basic concepts in documentation: why and how in documentation- Primary, Secondary and Tertiary documentation	
2.	Definition, Scope and Meaning of traditional knowledge and practices	
3.	Scouting of traditional knowledge Tool Kit- WIPO Constraints in scouting Strategies to facilitate scouting Reasons for refusal to share ITK	
4.	Analysing the scientific rationality of different traditional knowledge and practices in agriculture and animal husbandry	
5.	Validation of traditional knowledge and practices in agriculture and animal husbandry	
6.	Strategies to integrate ITK's for scientific research process	
7.	Entwining the scientific knowledge with traditional knowledge to develop cost effective viable prototype model in agriculture and animal husbandry	
8.	ITK and IPR Key Issues- IPR	
9.	Protection of ITK in Indian Acts	
10.	Traditional Knowledge Digital Library TKDL	

Reference Books

1.	Mishra, Anupam, Singh, S.R.K., Raut, A.A. Traditional Knowledge in Agriculture. 2020. Division of Agricultural Extension, ICAR, New Delhi.
1.	WIPO, Documenting Traditional Knowledge- Toolkit WIPO. 2017. Publication Number 1049E. Switzerland.
2.	Nisha, D.D., Amulya.G. Intellectual Property Rights and the protection of the traditional knowledge. 2019. Business Science Reference, India.

Mode of Evaluation: Project Planning and Writing, Presentation, Regularity, Monthly Assessment, Output delivery, Technical Skill Development, Entrepreneurship Skills, Business networking skills, Report Writing Skills and Final Presentation

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Agronomy							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
AGRAG101	Fundamentals of Agronomy	Embedded T & L	3	0	2	4	None
AGRAG202	Crop Production Technology – I (Kharif Crops)	Embedded T & L	1	0	2	2	AGR101
AGRAG203	Crop Production Technology – II (Rabi Crops)	Embedded T & L	1	0	2	2	AGR101
AGRAG204	Farming System & Sustainable Agriculture	Theory	1	0	0	1	AGR101
AGRAG205	Introductory Agro-Meteorology and Climate Change	Embedded T & L	1	0	2	2	None
AGRAG308	Geoinformatics, Nanotechnology and Precision Farming	Embedded T & L	1	0	2	2	AGR204
AGRAG309	Practical Crop Production – I (Kharif Crops)	Practical	0	0	4	2	AGR202
AGRAG310	Rainfed Agriculture & Watershed Management	Embedded T & L	1	0	2	2	AGR204
AGRAG311	Practical Crop Production – II (Rabi Crops)	Practical	0	0	4	2	AGR203
AGRAG312	Principles of Organic Farming	Embedded T & L	1	0	2	2	None

Course code	**Fundamentals of Agronomy**	**L**	**T**	**P**	**C**
AGRAG101		**3**	**0**	**2**	**4**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on different crops, crop nutrition and growth
2. Describing crop-water relations in association to crop growth and development
3. Illustrating crop management, cropping pattern and weed management

Expected Course Outcome: At the end of the course the student should be able to

1. Express knowledge gained on the principles of agronomy.
2. Recognize the various nutrients and their effects on plant health.
3. Plan irrigation measures for plant growth and development.
4. Manage weeds in a field.
5. Plan for sustainable agricultural production.
6. Apply scientific methods and tools in field preparation and for designing cropping

Module:1	**Agronomy of crops, and soils**	**7 hours**
Agronomy - Definition - Importance and scope - Agro-climatic zones of Tamil Nadu - Agro ecological zones of India - Crops and their classification - Economic and agronomic - Major crops of India and Tamil Nadu - Major soils of Tamil Nadu - Factors affecting crop production - climatic - edaphic - biotic - physiographic and socio-economic factors.		
Module:2	**Tillage and Sowing**	**7 hours**
Tillage - Definition - Types - Objectives - Modern concepts of tillage - Main field preparations - Seeds - seed rate - sowing methods - Crop establishment methods - Planting geometry and its effect on growth and yield - After cultivation -Thinning - Gap filling.		
Module:3	**Weed Management**	**7 hours**
Weeds-importance, classification, crop weed competition, concepts of weed management. principles and methods, herbicides-classification, selectivity, resistance, and allelopathy. Biotechnology and Nanotechnology in Weed Science. Site Specific Weed Management and Integrated Weed Management.		
Module:4	**Crop nutrition; Growth and Development**	**7 hours**
Essentiality of Crop nutrition - manures and fertilizers - Nutrient use efficiency. Site Specific Integrated Nutrient Management. Growth and development of crops. Factors affecting growth and development; plant ideotypes.		
Module:5	**Soil-plant-water-relations**	**6 hours**
Water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation-scheduling criteria and methods, quality of irrigation water and logging - Deficit Irrigation.		
Module:6	**Cropping and Farming System Management**	**6 hours**
Cropping pattern and system - Crop rotation and its principles; adaptation and distribution of crops – Mixed Cropping and Integrated Farming System. Organic / eco - friendly agriculture - Dry farming- principles and concepts. Crop management technologies in problematic soils and management. Harvesting and threshing of crops.		
Module:7	**Sustainable Agriculture**	**6 hours**
Principles of Sustainable Agriculture (SA) – Benefits of SA; Management and Practices of SA – Resource Conservation Techniques for Sustainable Agriculture- Non-Renewable and Renewable Energy for Sustainable Agriculture.		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**48**
Textbooks		
1.	Yellamanda Reddy T, Sankara Reddy. Principles of Agronomy, 6th edition, 2023. Kalyani Publishers, India.	
2.	Singh S. S, and Rajesh Singh. Advanced Principles and Practices of Agronomy. 2018. Kalyani Publishers, India.	
Reference Books		
1.	Franeisco J. Villalobos and Elias Fereres. Principles of Agronomy for Sustainable Agriculture, 2016. Springer, Mexico.	
2.	Chandrasekaran, B., Annadurai, K. and Somasundaram, E. A Textbook of Agronomy. . 2018. New Age International Publishers, New Delhi.	
Mode of assessment: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
1.	Visit to institute farm to observe wetland farming system and identification of crops.	**2.5 hours**
2.	Visit to institute farm to observe garden land dryland farming system	**2.5 hours**

	and identification of crops.	
3.	Mapping of Agro-climatic zones in India and Tamil Nadu	**2.5 hours**
4.	Identification of seeds, manures, fertilizers, green manures, and green leaf manures	**2.5 hours**
5.	Identification of tools, implements and Machineries; Acquiring skill in handling primary and secondary tillage implements.	**2.5 hours**
6.	Practicing different methods of land configuration for raising nursery for wet land and garden land crops.	**2.5 hours**
7.	Practicing different methods of seed treatments, methods of sowing and seeding implements; Seed germination and viability test	**2.5 hours**
8.	Working out seed rates and plant population; practicing thinning, gap filling intercultural operations.	**2.5 hours**
9.	Identification of fertilizers, manures and pesticides and methods of application	**2.5 hours**
10.	Identification of weeds, herbicides, and methods of application	**2.5 hours**
11.	Soil moisture measuring devices and measurements of irrigation water	**2.5 hours**
12.	Measurement of field capacity, bulk density, and infiltration rate	**2.5 hours**
13.	Numerical exercises on fertilizer requirement, herbicide calculation plant population and Crop water requirement	**2.5 hours**
14.	Yield contributing characters and yield estimation	**2.5 hours**
15.	Practicing harvesting operations in major field crops.	**2.5 hours**
16.	Visit to nearby Agricultural Research station.	**2.5 hours**
	Total Laboratory Hours:	**40**
Textbooks		
1.	Yellamanda Reddy T, Sankara Reddy. Principles of Agronomy, 6th edition, 2023. Kalyani Publishers, India.	
2.	Chandrasekaran, B., Annadurai, K. and Somasundaram, E. A Textbook of Agronomy. 2018. New Age International Publishers, India.	
Reference Books		
1.	Nanwal, R.K. and S.S. Walia. Recent advances in Agronomy. 2023. Scientific Publishers. India.	
2.	Arun Katyayan. Fundamentals of Agriculture. Volume 1 and 2. 2017. Kushal Publications and Distributors, India.	
Mode of Assessment: Internal Assessment and Final Assessment Test		
Recommended by Board of Studies	28.02.2024	
Approved by Academic Council	No.73	**Date** 15.03.2018

Course Code	**Crop Production Technology – I (*Kharif* Crops)**	**L**	**T**	**P**	**C**
AGRAG202		**1**	**0**	**2**	**2**
Pre-requisite	Fundamentals of Agronomy	**Syllabus version**			
AGRAG101		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on origin, distribution, climatic requirements and varieties of kharif crops
2. Demonstrating practical applications of crop production
3. Providing knowledge on the practices followed in growing kharif crops

Expected Course Outcome: At the end of the course the student should be able to

1. Demonstrate the conceptual knowledge of important agricultural processes needed to grow crops successfully
2. Show competency in sustainable field crop management.
3. Comprehend cultivation practices of *kharif* crops.
4. Analyse comparative benefits of the different *kharif* crops
5. Examine the constraints in production of *kharif* crops
6. Correlate parameters involved in crop cultivation and practice kharif crop cultivation

Module:1	**Cereals**	**3 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rice and Maize		
Module 2	**Millets**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Sorghum, Pearl millet and Finger millet		
Module:3	**Pulses**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Pigeon pea, Greengram, Blackgram and Cowpea.		
Module:4	**Oil Seeds**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Groundnut, Sesame, Soybean and Castor		
Module:5	**Cotton**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Cotton		
Module:6	**Other fibre crops**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Jute and Mesta		
Module:7	**Forage Crops**	**1 hour**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of fodder sorghum, fodder cowpea, cluster bean and Bajra Napier.		
Module:8	**Contemporary Issues**	**2 hour**
Lecture by Industrial Expert		
	Total Lecture hours	**16**

Text Books

1.	Srinivasan Jeyaraman. Field Crops Production and Management, Volume 1 & 2. 2018. Oxford & IBH Publishing Co. Pvt. Ltd., India.
2.	S. R. Reddy. Agronomy of Field Crops. 2016. Kalyani Publishers, India.

Reference Books

1.	Rajendra Prasad. Textbook of Field Crops Production Volume 1 & 2 (Food grain Crops & Commercial Crops). 2017. ICAR, India.
2.	Crop Production Guide. 2020. Department of Agriculture and TNAU.
3.	Pratik Sanodiya. Crop Production Technology of Kharif Crops. 2022. Kalyani Publishers, India.

Mode of Assessment: Assignment, Mid-semester and Final Assessment Test

Indicative Experiments

1.	Practicing preparation of various nursery types in rice	**2.5 hours**
2.	Practical skill on Transplanting of Rice	**2.5 hours**

3.	Study of morphological description of kharif season crops	**2.5 hours**
4.	Acquiring skill in different seed treatment techniques in kharif crops	**2.5 hours**
5.	Study of crop varieties and important agronomic experiments at experimental farm	**2.5 hours**
6.	Acquiring skill in sowing of Maize, Sorghum and pearl millet	**2.5 hours**
7.	Acquiring skill in sowing of Pulses, Oil seeds and cotton	**2.5 hours**
8.	Workout the plant population and seed rate requirements for *kharif* crops	**2.5 hours**
9.	Study the effect of seed size on germination and seedling vigor of *kharif* crops	**2.5 hours**
10.	Study the effect of sowing depth on germination of *kharif* crops	**2.5 hours**
11.	Identification of weeds in *kharif* season crops	**2.5 hours**
12.	Acquiring skill in top dressing and foliar nutrition for important *kharif* crops	**2.5 hours**
13.	Study of yield contributing characters and yield calculation of kharif crops	**2.5 hours**
14.	Study of crop varieties and important agronomic experiments at experimental farm	**2.5 hours**
15.	Study of forage experiments	**2.5 hours**
16.	Visit to research centres of related crops.	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Books	
1.	Srinivasan Jeyaraman. Field Crops Production and Management, Volume 1 & 2. 2018. Oxford & IBH Publishing Co. Pvt. Ltd., India.
2.	Abhijit Sarma Numerical Agronomy, 5th edition, 2020. Kalyani Publishers, India.
Reference Books	
1.	Rajendra Prasad. Textbook of Field Crops Production Volume 1 & 2 (Food grain Crops & Commercial Crops). 2017. ICAR, India.
2.	Crop Production Guide. 2020. Department of Agriculture and TNAU.
Mode of Assessment: Internal Assessments and Final Assessment Test	
Recommended by Board of Studies	28-02-2024
Approved by Academic Council	No. 73 **Date** 15-03-2024

Course Code	**Crop Production Technology – II (*Rabi* Crops)**	**L**	**T**	**P**	**C**
AGRAG 203		**1**	**0**	**2**	**2**
Pre-requisite	Fundamentals of Agronomy	**Syllabus version**			
AGRAG 101		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on origin, distribution, climatic requirements and varieties of rabi crops
2. Demonstrating practical applications of crop production
3. Providing knowledge on the importance and practices followed in growing rabi crops

Expected Course Outcome: At the end of the course the student should be able to

1. Demonstrate the conceptual knowledge of important agricultural processes needed to grow crops successfully
2. Develop competency in sustainable field crop management.

3. Comprehend cultivation practices of *rabi* crops. 4. Analyze comparative benefits of the different *rabi* crops 5. Examine the constraints in production of *rabi* crops 6. Correlate parameters involved in crop cultivation and practice rabi crop cultivation		
Module:1	**Wheat**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Wheat		
Module:2	**Barley and Oats**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Barley and Oats		
Module:3	**Pulses**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Chickpea, Lentil and Peas		
Module:4	**Oil Seeds**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rapeseed, Mustard, Sunflower, Safflower		
Module:5	**Sugarcane**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Sugarcane		
Module:6	**Forage Crops**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Berseem, Lucerne and Oat.		
Module:7	**Medicinal And Aromatic plants**	**2 hours**
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Mentha, Lemon grass and Citronella.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**
Text Books		
1.	Srinivasan Jeyaraman. Field Crops Production and Management, Volume 1 & 2. 2018. Oxford & IBH Publishing Co. Pvt. Ltd., India.	
2.	S. R. Reddy. Agronomy of Field Crops. 2016. Kalyani Publishers, India.	
Reference Books		
1.	Rajendra Prasad. Textbook of Field Crops Production Volume 1 & 2 (Food grain Crops & Commercial Crops). 2017. ICAR, India.	
2.	Shailendra Singh Kushwah, Suresh Singh Tomar and Yagya Dev Mishra. Production Technology of Rabi Crops. 2018. Biotech Books, India.	
3.	Crop Production Guide. 2020. Department of Agriculture and TNAU.	
Mode of Assessment: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
1.	Acquiring skill in methods of Wheat sowing	**2.5 hours**
2.	Acquiring skill in different methods of sugarcane planting	**2.5 hours**
3.	Acquiring skill in different seed treatment techniques in *rabi* crops	**2.5 hours**
4.	Workout the plant population and seed rate requirements for *rabi* crops	**2.5 hours**
5.	Workout the inputs requirements for *rabi* crops	**2.5 hours**

6.	Study of morphological characteristics of *rabi* cereals	**2.5 hours**
7.	Study of morphological characteristics of *rabi* pulses and oilseeds	**2.5 hours**
8.	Study of morphological characteristics of sugarcane	**2.5 hours**
9.	Identification of weeds in *rabi* season crops	**2.5 hours**
10.	Study of growth and yield contributing characters of cereals	**2.5 hours**
11.	Study of growth and yield contributing characters of pulses and oil seeds	**2.5 hours**
12.	Study of growth and yield contributing characters of sugarcane	**2.5 hours**
13.	Study of forage experiments	**2.5 hours**
14.	Study of important agronomic experiments of *rabi* crops at experimental farms	**2.5 hours**
15.	Oil extraction from medicinal crops	**2.5 hours**
16.	Visit to research centres of related crops.	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Books	
1.	Srinivasan Jeyaraman. Field Crops Production and Management, Volume 1 & 2. 2018. Oxford & IBH Publishing Co. Pvt. Ltd., India.
2.	Abhijit Sarma. Numerical Agronomy, 5th edition. 2020. Kalyani Publishers, India.
Reference Books	
1.	Rajendra Prasad. Textbook of Field Crops Production Volume 1 & 2 (Food grain Crops & Commercial Crops). 2017. ICAR, India.
2.	Crop Production Guide. 2020. Department of Agriculture and TNAU.

Mode of assessment: Internal assessments and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	15-03-2024

Course Code	**Farming System and Sustainable Agriculture**	**L**	**T**	**P**	**C**
AGRAG204		**1**	**0**	**0**	**1**
Pre-requisite	Fundamentals of Agronomy	**Syllabus version**			
AGRAG101		1.0			

Course Objectives Course Objectives: The course is aimed at

1. Imparting knowledge on the types of farming systems
2. Describing cropping systems and state the importance of sustainable agriculture
3. Explaining integrated farming system

Expected Course Outcome: At the end of the course the student should be able to

1. Interpret farming systems and its significance
2. Design an efficient cropping system and demonstrate sustainability in agriculture
3. Propose integrated farming systems and determine the efficiency of farming systems

Module:1	**Farming System**	**2 hours**

Farming System - scope, importance and concept. Types of farming system and factors affecting types of farming. Farming system components and their maintenance.

Module:2	**Cropping system**	**2 hours**

Cropping system and pattern, multiple cropping systems, efficient cropping system and their evaluation. Allied enterprises and their importance.

Module:3	**Efficiencies in cropping and farming system**	**2 hours**
Tools for determining production and efficiencies in cropping and farming system.		
Module:4	**Sustainable agriculture**	**2 hours**
Sustainable agriculture - problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation.		
Module:5	**Conservation agriculture**	**2 hours**
Conservation agriculture strategies in agriculture, HEIA, LEIA, LEISA and its techniques for sustainability.		
Module:6	**Integrated farming system**	**2 hours**
Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, site-specific development of IFS model for different agro-climatic zones		
Module:7	**Resource use efficiency**	**2 hours**
Resource use efficiency and optimization techniques. Resource cycling and flow of energy in a different farming system and environment. Visit of IFS model in different agro-climatic zones of nearby state's University/ institutes and farmers field.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text Books	
1.	Reddy, S.R. Farming System and Sustainable Agriculture. 2020. Kalyani Publishers, India.
2.	Walia, S.S and U.S. Walia. Farming System and Sustainable Agriculture. 2020. Scientific Publishers, India.
3.	Nanwal, R. K. Farming System and Sustainable Agriculture. 2019. New India Publishing Agency, India.
Reference Books	
1.	Anant Kumar, Joginder Singh, Rashmi Nigam, Sanjay Swami, Yogesh Kumar Agarwal and Heera Lal. Integrated Farming Systems and Sustainable Agriculture. 2022. Biotech Books Publishers, India.
2.	Shawn Jadrnicek and Stephanie Jadrnicek. The Bio-Integrated Farm: A Revolutionary Permaculture-Based System Using Greenhouses, Ponds, Compost Piles, Aquaponics, Chickens and More. 2016. Chelsea Green Publishing, USA.

Mode of Evaluation: Assignment, Mid-semester and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	14-03-2024

Course Code	**Introductory Agro-meteorology and Climate Change**	**L**	**T**	**P**	**C**
AGRAG205		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed to

1. Explain the importance of agro-meteorology and its uses in agricultural field
2. Discuss about climate change and its impact on agriculture.
3. Illustrate the relationship between crop and weather to predict various crop yields

Expected Course Outcome: Upon completion students will be able to

1. Appreciate the importance of weather variables in agriculture
2. Comprehend the role solar radiation in crop growth
3. Analyze various forms of precipitation
4. Interpret the role of weather hazards and climate change in crop growth
5. Understand the correlation between weather and agriculture
6. Measure weather parameters essential for crop growth

Module:1	**Agro-meteorology**	**2 hours**
Meaning and scope of agricultural meteorology. Earth's atmosphere-its composition, extent and structure. atmospheric weather variables.		
Module:2	**Atmospheric variable**	**2 hours**
Atmospheric pressure, its variation with height. Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze, and sea breeze. Atmospheric humidity, the concept of saturation, vapor pressure.		
Module:3	**Solar radiation and its components**	**2 hours**
Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave,longwave and thermal radiation, net radiation, Energy balance of earth and albedo. Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature.		
Module:4	**Condensation and Precipitation**	**2 hours**
Process of condensation, formation of dew, fog, mist, frost, cloud. Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail.		
Module:5	**Clouds and Monsoon Mechanism**	**2 hours**
Cloud formation and classification. Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture.		
Module:6	**Weather Hazards**	**2 hours**
Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations, modifications of crop microclimate, climatic normals for crop and livestock production.		
Module:7	**Weather Forecasting**	**2 hours**
Weather forecasting-types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national agriculture.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text Books

1.	Chouhan, B.S., H.K. Sumeriyaand L.L. Somani. 2017. Introductory Agrometeorology andClimate Change. Bio-Green Books, India.
2.	G.S. Mahi and P.K. Kingra. 2018. Fundamentals of Agrometeorology & Climate Change.Kalayani Publishers, India.

Reference Books

1.	S.R.Reddy. 2019. Introduction to Agriculture and Agrometeorology. Kalayani Publishers,India.
2.	Pratik Sanodiya and Rani Lakshmi Bai. 2019. Introductory Agro Meteorology and Climate Change. Akinik Publications, India

Mode of Evaluation: Assignment, Mid-semester and Final Assessment Test

Indicative Experiments

1.	Visit to agrometeorological observatory, study of site selection of observatory, exposure to instruments and weather data recording.	**2.5 hours**
2.	Measurement of solar radiation (Pyranometers), Sunshine hours (sunshine recorder) – working out weekly and monthly mean for graphical representation	**2.5 hours**
3.	Measurement of air and soil temperature and grass minimum thermometers and thermographs – drawing isolines	**2.5 hours**
4.	Determination of Relative humidity, vapor pressure and dew point temperature – Use of wet bulb and dry bulb thermometers – psychrometers - Hygrographs	**2.5 hours**
5.	Measurement of atmospheric pressure – barograph – Fortean's barometer and analysis of atmosphericconditions.	**2.5 hours**
6.	Measurement of wind speed and wind direction, preparation of wind rose.	**2.5 hours**
7.	Measurement of rainfall – Ordinary and Self-recording rain gauges – Measurement of Dew – Dew gauge – Study of automatic weather station	**2.5 hours**
8.	Measurement of evaporation - Open pan evaporimeter – application of evaporation data – Measurement of Evapotranspiration - Lysimeter	**2.5 hours**
9.	Heat unit concept – GDD, HTU, PTU for fixing time of sowing	**2.5 hours**
10.	Probability analysis of rainfall for crop planning	**2.5 hours**
11.	Drawing synoptic charts to understand the weather	**2.5 hours**
12.	Preparation of crop weather calendars and forecast based Agro advisories	**2.5 hours**
13.	Estimation of length of growing periods using weekly rainfall data	**2.5 hours**
14.	Identification of efficient cropping zone – RYI, RSI	**2.5 hours**
15.	Mapping of agro-climatic zones of India and Tamil Nadu and its characterization	**2.5 hours**
16.	Visit to Agro-meteorology Observatory	**2.5 hours**
	Total Laboratory Hours	**40**

Text Book(s)	
1.	S.R.Reddy. 2019. Introduction to Agriculture and Agrometeorology. Kalayani Publishers,India.
Reference Book	
1.	Chouhan, B.S., H.K. Sumeriyaand L.L. Somani. 2017. Introductory Agrometeorology andClimate Change. Bio-Green Books, India.
2.	Pratik Sanodiya and Rani Lakshmi Bai. 2019. Introductory Agro Meteorology and Climate Change. Akinik Publications, India
Mode of assessment: Internal Assessments and Final Assessment Test	

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	14-03-2024

Course code	**Geoinformatics, Nanotechnology and Precision Farming**	**L**	**T**	**P**	**C**
AGRAG308		**1**	**0**	**2**	**2**
Pre-requisite	Farming System & Sustainable Agriculture				

AGRAG204	**Syllabus version**	1.0

Course Objectives: The course is aimed at

1. Introducing techniques involved in precision agricultural farming
2. Explaining the role of geographic information system, global positioning system and remote sensing in precision farming
3. Imparting knowledge on the use of nanotechnology in improving farm productivity

Expected Course Outcome: At the end of the course the student should be able to

1. Define the role of remote sensing in precision agriculture
2. Demonstrate the knowledge gained on geographical information system
3. Appreciate the role of global positioning system in precision farming
4. Comprehend simulation models on precision agriculture
5. Explain the role of nanotechnology in improving agriculture
6. Apply geoinformatics and nanotechnology in precision farming projects

Module:1	**Precision agriculture**	**2 hours**
Precision agriculture concepts, components, challenges and prospects in Indian agriculture, applications, crop discrimination and yield monitoring.		
Module:2	**Geo-informatics**	**2 hours**
Definition, concepts, tools, techniques and their use in agriculture. Soil mapping and fertilizer recommendation using geospatial technologies.		
Module:3	**Remote Sensing in Agriculture**	**2 hours**
Remote sensing concepts, classification, different sensors and platforms, image processing and interpretation, applications in agriculture.		
Module:4	**GIS in Agriculture**	**2 hours**
GIS concepts, components, data structure and formats, data types, application in agriculture.		
Module:5	**Global Positioning Systems**	**2 hours**
GPS concepts, components and it's functions, GPS types and its accuracy, GPS data processing, applications in agriculture.		
Module:6	**Crop Modeling**	**2 hours**
Introduction to crop simulation models and their uses for optimization of agricultural inputs, crop model types, STCR approach for precision agriculture.		
Module:7	**Nanotechnology**	**2 hours**
Definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text book

1.	Satish Kumar, Y.S. U.V.B. Reddy; P.V.R.M. Reddy; Ch. Sujani Rao and Ch. Bhargava Rami Reddy. Geo Informatics and Nano Technology in Precision farming. 2022. Brillion Publishers, India.

Reference books

1.	Salim Lamine, Prashant K. Srivastava, Ahmed Kayad, Francisco Munoz Arriola, Prem Chandra Pandey. Remote Sensing in Precision Agriculture. 2023. Academic Press, United States.
2.	S. R. Reddy. Geoinformatics and Nanotechnology for Precision Farming, 2021.

	Kalyani Publishers, India.	
Mode of Evaluation: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
1.	Introduction to QGIS software	**2.5 hours**
2.	Spatial data creation and editing using google earth pro; Spatial Data Creation and Editing using QGIS	**2.5 hours**
3.	Layer stacking / Merge raster (Merge multiple raster layers)	**2.5 hours**
4.	Introduction to image processing software; Visual and Digital interpretation of remote sensing images	**2.5 hours**
5.	Use of GPS for agricultural survey	**2.5 hours**
6.	Exporting GPS Data; Convert KML to Shape file in QGIS	**2.5 hours**
7.	Excel to shape file/ spatial layer generation	**2.5 hours**
8.	Georeferencing using QGIS	**2.5 hours**
9.	Spectral Signature Collection and Spectral Analysis; Generation of spectral profiles of different objects	**2.5 hours**
10.	Digitization using ARCinfo	**2.5 hours**
11.	Normalized Differential Vegetation Index (NDVI) using QGIS	**2.5 hours**
12.	Calculate the biophysical parameters of the canopy using SNAP	**2.5 hours**
13.	Supervised and unsupervised classification and acreage estimation	**2.5 hours**
14.	Creation of soil fertility map using GIS; Multispectral remote sensing for soil mapping. Creation of productivity and management zones.	**2.5 hours**
15.	Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology.	**2.5 hours**
16.	Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.	**2.5 hours**
	Total Laboratory Hours	**40**
Text Books		
1.	Ruth Kerry and Alexandre Escola. Sensing Approaches for Precision Agriculture. 2021. Springer Cham, Switzerland.	
Reference Books		
1.	Deepak G Panpatte and Yogeshvari K Jhala. Nanotechnology for Agriculture Advances for Sustainable Agriculture. 2019. Springer Singapore.	
Mode of assessment: Internal Assessments and Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No. 73 **Date**	14-03-2024

Course Code	**Practical Crop Production - I (*Kharif* Crops)**	**L**	**T**	**P**	**C**
AGRAG309		0	0	4	2
Pre-requisite	Crop Production Technology – I (*Kharif* Crops)		**Syllabus version**		
AGRAG202			1.0		
Course Objectives: The course is aimed at					

1. Planning and practicing cultivation of kharif crops.
2. Imparting knowledge on integrated nutrient pest and disease management
3. Sharing knowledge on marketing of produce and calculating cost benefit ratio

Expected Course Outcome: At the end of the course the student should be able to

1. Plan and decide on growing a suitable kharif crop; Decide on the best cropping system that can be followed for a kharif season.
2. Recommend package of practices for growing kharif crops; Practice kharif crop production through integrated management; Calculate cost benefit ratio based on cultivation and marketing expenses of a crop

Indicative Experiments

1.	Crop planning	**5 hours**
2.	Raising field crops in multiple cropping systems	**5 hours**
3.	Field preparation and Seed treatment	**5 hours**
4.	Nursery raising and sowing	**5 hours**
5.	Resource conservation techniques	**5 hours**
6.	Mechanization in Field (Kharif) Crops	**5 hours**
7.	Seed production and hybridization	**5 hours**
8.	Crop Growth Analysis	**5 hours**
9.	Identification of nutrient deficiency and toxicity in Kharif Crops	**5 hours**
10.	Integrated Nutrient Management	**5 hours**
11.	Weed Identification and Integrated Weed Management	**5 hours**
12.	Irrigation Management	**5 hours**
13.	Insect and Disease Identification and Integrated Management	**5 hours**
14.	Yield and Yield Attributes Analysis	**5 hours**
15.	Harvest and Post Harvest Management, Marketing of Produce	**5 hours**
16.	Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students	**5 hours**
	Total Laboratory Hours:	**80**

Textbooks

1. Rajendra Prasad. Textbook of field crops production. 6th Revised Edition Volume 1 and 2. 2021. ICAR, India.
2. Lokesh Kumar Jain. A Manual on Crop Production Technology (Kharif and Rabi). 1st Edition. 2021. Bhavya Books Publishers, India.

Reference Books

1. Reddy, S.R and Reddi Ramu Y. Agronomy of Field Crops. 5th edition. 2016. Kalyani Publishers, India.

Mode of Assessment: Continuous Assessments of Field Work & Final Assessment Test

Recommended by Board of Studies	28.02.2024		
Approved by Academic Council	No. 73	**Date**	14.03.2024

Course Code	**Rainfed Agriculture & Watershed Management**	**L**	**T**	**P**	**C**
AGRAG310		**1**	**0**	**2**	**2**
Pre-requisite	Farming System & Sustainable Agriculture	**Syllabus version**			
AGRAG204		1.0			

Course Objectives: The course is aimed at

1. Explaining the problems faced in rainfed agricultural systems
2. Imparting knowledge of drought management strategies
3. Describing watershed management techniques

Expected Course Outcome: At the end of the course the student should be able to

1. Build knowledge on solving problems related to rainfed agriculture
2. Identify several drought management strategies
3. Plan crop and water management approaches to mitigate drought
4. Perceive the necessity and difficulties of watershed management
5. Recommend practices to be followed in rainfed farming systems
6. Do contingency planning for aberrant weather conditions

Module:1	**Rainfed agriculture**	**2 hours**
Introduction, types, history of rainfed agriculture and watershed in India. Problems and prospects of rainfed agriculture in India. Soil and climatic conditions prevalent in rainfed areas.		
Module:2	**Soil water conservation**	**2 hours**
Soil and water conservation techniques in rainfed areas.		
Module:3	**Drought management**	**2 hours**
Drought: types. The effect of water deficit on physio-morphological characteristics of the plants.		
Module:4	**Mitigation of drought**	**2 hours**
Crop adaptation, and mitigation of drought.		
Module:5	**Water harvesting**	**2 hours**
Water harvesting: importance, its techniques, efficient utilization of water through soil and crop management practices.		
Module:6	**Contingency crop planning**	**2 hours**
Management of crops in rainfed areas. Contingent crop planning for aberrant weather conditions.		
Module:7	**Watershed management**	**2 hours**
Concept, objective, principles, and components of watershed management. Factors affecting watershed management.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text Books

1.	Subbareddy, G., Reddy, Y.V.R, Vittal, K.P.R, Thyagaraj, C.R., Ramakrishna, Y.S. and Somani, L.L. Dryland Agriculture. 2nd Edition, 2016. Agrotech Publishing Academy, India.
2.	Oswal. M.C. Watershed Management (for Dryland Agriculture). 2017. Associated Publishing Company. India.

Reference Books

1.	SR Reddy and G. Prabhakara Reddy. Rainfed Agriculture & Watershed Management. 2018. Kalyani Publications, India.
2.	Singh, S.S. Crop management under rainfed and irrigated conditions. 2016. Kalyani Publishers, India.

Mode of Evaluation: Assignment, Mid-semester and Final Assessment Test

Indicative Experiments

1.	Dry climate classification	**2.5 hours**
2.	Studies on climate classification, studies on rainfall patterns in rainfed areas of the country and patterns of onset and withdrawal of monsoons.	**2.5 hours**
3.	Agro-climatic zones of India and Tamil Nadu and Agro-ecological zones of India	**2.5 hours**
4.	Studies on cropping patterns of different rainfed areas in the country.	**2.5 hours**
5.	Demarcation of the rainfed area on the map of India.	**2.5 hours**
6.	Scheduling of supplemental irrigation based on crop Evapotranspiration demand of crops	**2.5 hours**
7.	Critical analysis of rainfall – interpretation of meteorological data for rainfall variability,	**2.5 hours**
8.	Calculation of effective rainfall	**2.5 hours**
9.	Calculation of wet spell, dry spell and length of growing period	**2.5 hours**
10.	Studies on cultural practices for mitigating moisture stress.	**2.5 hours**
11.	Characterization and delineation of the model watershed.	**2.5 hours**
12.	Field demonstration on soil and moisture conservation measures.	**2.5 hours**
13.	Field demonstration on the construction of water harvesting structures.	**2.5 hours**
14.	Mechanization in dryland farming	**2.5 hours**
15.	Alternate land use system	**2.5 hours**
16.	Visiting rainfed research station/watershed.	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Pal Mahendra Singh. Concepts and Principles of Rainfed Agriculture and Watershed Management. 2023. New India Publishing Agency, India.	
Reference Books		
1.	Rajesh Rajora. Integrated watershed management: Field Manual for Equitable, Productive and Sustainable Development. 2019. Rawat Pubns, India.	
2.	Nanwal, R.K. Rainfed Agriculture and Watershed Management. 2019. NIPA Genx Electronic. India.	
Mode of assessment: Internal Assessments and Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No. 73 **Date** 14-03-2024	

Course Code	**Practical Crop Production - II (*Rabi* Crops)**	**L**	**T**	**P**	**C**
AGRAG311		**0**	**0**	**4**	**2**
Pre-requisite	Crop Production Technology - II (*Rabi* Crops)	**Syllabus version**			
AGRAG203		1.0			
Course Objectives: The course is aimed at					
1. Planning and practicing cultivation of rabi crops 2. Imparting knowledge on integrated nutrient pest and disease management 3. Sharing knowledge on marketing of produce and calculating cost benefit ratio					
Expected Course Outcome: At the end of the course the student should be able to					

1. Plan and decide on growing a suitable rabi crop; Decide on the best cropping system that can be followed for a rabi season 2. Recommend package of practices for growing rabi crops; Practice rabi crop production through integrated management; Calculate cost benefit ratio based on cultivation and marketing expenses of a crop		
Indicative Experiments		
1.	Crop planning	**5 hours**
2.	Raising field crops in multiple cropping systems	**5 hours**
3.	Field preparation and Seed treatment	**5 hours**
4.	Nursery raising and sowing	**5 hours**
5.	Resource conservation techniques	**5 hours**
6.	Mechanization in Field (Kharif) Crops	**5 hours**
7.	Seed production and hybridization	**5 hours**
8.	Crop Growth Analysis	**5 hours**
9.	Identification of nutrient deficiency and toxicity in Kharif Crops	**5 hours**
10.	Integrated Nutrient Management	**5 hours**
11.	Weed Identification and Integrated Weed Management	**5 hours**
12.	Irrigation Management	**5 hours**
13.	Insect and Disease Identification and Integrated Management	**5 hours**
14.	Yield and Yield Attributes Analysis	**5 hours**
15.	Harvest and Post-Harvest Management, Marketing of Produce	**5 hours**
16.	Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students	**5 hours**
	Total Laboratory Hours:	**80**
Text Books		
1.	Rajendra Prasad. Textbook of field crops production. 6th Revised Edition Volume 1 and 2. 2021. ICAR, India.	
2.	Suresh Singh Tomar, Yagya Dev Mishra and Shailendra Singh Kushah. Production Technology of Rabi Crops. 2018. Biotech Books, India.	
Reference Books		
1.	Chhidda, S., Singh P. and Singh R. Modern techniques of raising field crops. 3rd Revised Edition. 2020. Oxford & IBH Publishing Co Pvt. Ltd., India.	
2.	Joshi M. Textbook of Field Crops. Revised Edition. 2018. Prentice Hall India Learning Private Limited, India.	
Mode of assessment: Continuous Assessments of Field Work & Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No. 73 **Date**	14-03-2024

Course Code	**Principles of Organic Farming**	**L**	**T**	**P**	**C**
AGRAG312		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the scope and concepts of organic farming in India
2. Discussing on indigenous weed, pest, disease, and nutrient management for organic farming
3. Educating students on the certification and marketing of organic farm produces

Expected Course Outcome: At the end of the course the student should be able to

1. Analyze the scope of organic farming.
2. Recommend varieties suitable for organic farming.
3. Comprehend management practices suitable for organic farming.
4. Understand processing and marketing of organic products.
5. Develop entrepreneur skills and ideas to practice organic farming.
6. Develop an organic farm

Module: 1	**Scope and importance of organic farming**	**2 hours**
Organic farming, principles, and its scope in India - Characteristics relevance to modern agriculture - Initiatives taken by central and state. Government, NGOs, and other Organizations for promotion of organic agriculture – Current Status of Organic Farming in Tamil Nadu, India and the World		
Module: 2	**Organic ecosystem and crop rotation**	**2 hours**
Organic ecosystem and their concepts; Different ecofriendly farming systems; biological farming, natural farming, regenerative agriculture; permaculture; biodynamic farming - Choice of crops and varieties in organic farming; crop rotations – need and benefits – multiple cropping.		
Module: 3	**Soil fertility and nutrient management**	**2 hours**
Soil fertility and productivity; Organic nutrient resources and their fortification - Organic manures; methods of Composting; Green manures; bio-fertilizer types, methods of application; benefits and limitations- Restrictions to nutrient use in organic farming -		
Module: 4	**Weed management in organic agriculture**	**2 hours**
Principles Organic Weed Management: Cultural, Mechanical, Thermal and Biological methods of weed control; Role of Allelopathy and Bioherbicides in organic weed management.		
Module: 5	**Soil and water conservation techniques**	**2 hours**
Biodiversity of soil and water. Insitu and Exitu Soil moisture conservation techniques and Water harvesting methods. Resource Conservation Techniques (RCT).		
Module: 6	**Insect and disease management in organic agriculture**	**2 hours**
Fundamentals of insect, and disease management under organic mode of production- Biopesticides and Its Uses and Constraints in organic crop production.		
Module:7	**Certification and marketing**	**2 hours**
Inspection and Certification process - Accreditation and standards of organic farming - Processing, leveling, economic considerations and viability, marketing, and export potential of organic products - Operational structure of National Programme for Organic Production (NPOP). National and International Organic Organizations.		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text books

1. S.C. Panda. Organic Farming for sustainable agriculture. 2017. Kalyani

	Publishers. India	
2.	Palaniappan S. P and Annadurai K. Organic Farming Theory and Practice 2nd Edition. . 2022. Scientific Publishers, India.	
Reference Books		
1.	Dilip Nandwani. Organic Farming for Sustainable Agriculture. 2016. Springer. Germany.	
2.	Singh A. K. Organic Farming. 2017. New India Publishing Agency. India	
Mode of assessment: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
1.	Organic farms Visit to study the resource inventory of various components and their utilization.	**2.5 hours**
2.	Soil sampling and analysis for organic carbon and pesticide residue.	**2.5 hours**
3.	Raising of green manures (Sunnhemp / Dhaincha / Fodder cowpea).	**2.5 hours**
4.	Seed treatment and raising of field corps.	**2.5 hours**
5.	Preparatory cultivation and soil and water conservation Methods.	**2.5 hours**
6.	Preparation of enrich compost and vermicompost - A hands on experience on recycling techniques.	**2.5 hours**
7.	Preparation of bio-fertilizers / bio-inoculants and Quantification of nutrients from organic sources.	**2.5 hours**
8.	Exposure visits to an organic farm to learn ITK based preparations.	**2.5 hours**
9.	ITK for weed Management in Organic Production System.	**2.5 hours**
10.	ITK for Insect Management in Organic Production System.	**2.5 hours**
11.	ITK for Disease Management in Organic Production System.	**2.5 hours**
12.	Exposure on macro quality analysis of organic source and crop produces in laboratories.	**2.5 hours**
13.	Exposure visits to bio-control agent production units.	**2.5 hours**
14.	Hands on training on post-harvest management.	**2.5 hours**
15.	Exposure visits to organic market outlets.	**2.5 hours**
16.	Exposure visits to organic certification agencies.	**2.5 hours**
	Total Laboratory Hours:	**40**
Textbooks		
1.	Sarath Chandran, C. Sabu Thomas and M. R. Unni. Organic Farming New Advances Towards Sustainable Agricultural Systems1st Edition. . 2019. Springer International Publishing, Germany.	
2.	Reddy, S.R. Principles of organic farming. 2017. Kalyani publishers, India.	
Reference Books		
1.	Vijay Singh Meena, Sunita Kumari Meena and Cherukumalli Srinivasarao. Advances in Organic Farming Agronomic Soil Management Practices. 2021. Springer International Publishing, Germany.	
2.	Dilip Nandwani. Organic Farming for Sustainable Agriculture. 2016. Springer. Germany.	
Mode of Evaluation: Internal assessments and Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date** 14-03-2024	

Genetics & Plant Breeding							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
GPBAG101	Fundamentals of Genetics	Embedded T & L	2	0	2	3	None
GPBAG202	Fundamentals of Plant Breeding	Embedded T & L	2	0	2	3	None
GPBAG203	Principles of Seed Technology	Embedded T & L	1	0	4	3	None
GPBAG305	Crop Improvement – I (Kharif Crops)	Embedded T & L	1	0	2	2	GPBAG202
GPBAG306	Crop Improvement – II (Rabi Crops)	Embedded T & L	1	0	2	2	GPBAG202

Course code	**Fundamentals of Genetics**	**L**	**T**	**P**	**C**
GPBAG101		**2**	**0**	**2**	**3**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the fundamental aspects of genetics and its applications
2. Describing cell division and the functions of the genetic material
3. Illustrating the molecular mechanisms of inheritance and gene regulation

Expected Course Outcome: At the end of the course the student should be able to

1. Apply the knowledge gained on inheritance and variation
2. Develop problem-solving skills pertaining to inheritance
3. Relate mutation to evolution and heredity
4. Interpret the functions of genetic material.
5. Solve and analyze problems in basic genetics
6. Judge the pattern of inherited traits

Module:1	**Principles of inheritance**	**8 hours**

Pre and Post Mendelian concepts of heredity. Mendelian principles of heredity for qualitative traits. Chromosomal theory of inheritance. Dominance relationships and epistatic interactions with examples. Multiple alleles, blood group genetics, pleiotropism and pseudoalleles. Probability and Chi-square.

Module:2	**Linkage**	**4 hours**

Recombination and its estimation, crossing over mechanisms and chromosome mapping. Sex determination, sex linkage, sex limited and sex influenced traits.

Module:3	**Quantitative and maternal inheritance**	**3 hours**

Quantitative traits, polygenes, continuous variations, multiple factor hypothesis and cytoplasmic inheritance.

Module:4	**Chromosome architecture**	**3 hours**

Chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere. Classification of chromosomes. Special types of chromosomes.

Module:5	**Mutation**	**4 hours**
Mutation: classification, methods of inducing mutations and CIB technique, mutagenic agents and induction of mutation. Structural and numerical variations in chromosome and their implications. Genetic disorders. Use of haploids, dihaploids and doubled haploids in genetics.		
Module:6	**Cell cycle**	**2 hours**
Cell division: Mitosis and meiosis.		
Module:7	**Structure and functions of genetic material**	**6 hours**
Nature, structure and replication of genetic material. Protein synthesis, transcription and translational mechanism of genetic material. Gene concept: Gene structure, function and regulation. Lac and Trp operons.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**32**

Text Books	
1.	Singh, B.D. Genetics. 2020. Latest edition. Kalyani Publishers, India.
2.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger and Anthony Bretscher. Molecular Cell Biology. 2021. 8th edition, W.H. Freeman. USA.
Reference Books	
1.	Snustad. D.P and Simmons, M.J. Principles of genetics. 2015. 7th edition. Wiley, USA.
2.	David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry: International Edition. 2017. 7th edition, W.H. Freeman. USA.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Principles and handling of microscopes	**2.5 hours**
2.	Studying the diversity of cells	**2.5 hours**
3.	Analyzing experimental data of monohybrid, test and back cross populations	**2.5 hours**
4.	Analyzing experimental data of dihybrid and trihybrid cross	**2.5 hours**
5.	Identification of inheritance pattern based on offspring data and epistatic interactions	**2.5 hours**
6.	Testing discrete ratios by chi-square test	**2.5 hours**
7.	Calculating recombination frequencies between traits and construction of chromosomal maps based on two point and three point test cross data	**2.5 hours**
8.	Analyzing genetics based experimental data on probability	**2.5 hours**
9.	Sex Linked Inheritance	**2.5 hours**
10.	Quantitative inheritance	**2.5 hours**
11.	Growing root tips of onion and analyzing the mitotic stages	**2.5 hours**
12.	Comparisons of various stages of Meiosis I during microsporogenesis of *Rhoeo discolor*	**2.5 hours**
13.	Comparisons of various stages of Meiosis II during microsporogenesis of *Rhoeo discolor*	**2.5 hours**
14.	Study of models on DNA Structures	**2.5 hours**
15.	Study of models on RNA Structures	**2.5 hours**
16.	Learning the 64 codons	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Book				
1.	Singh, B.D. Genetics. 2020. Latest edition. Kalyani Publishers, India.			
Reference Books				
1.	Snustad. D.P and Simmons, M.J. Principles of genetics. 2015. 7th edition. Wiley, USA.			
2.	David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry: International Edition. 2017. 7th edition, W.H. Freeman. USA.			
Mode of Evaluation: Internal assessments and Final assessment test				
Recommended by Board of Studies		28-02-2024		
Approved by Academic Council		No.73	**Date**	14-03-2024

Course code	**Fundaments of Plant Breeding**	**L**	**T**	**P**	**C**
GPBAG202		**2**	**0**	**2**	**3**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Describing the importance of plant breeding
2. Imparting knowledge on means of exploiting plants through breeding
3. Introducing the role of biotechnology and IPR in crop improvement

Expected Course Outcome: At the end of the course the student should be able to

1. Understand how humans have flourished due to breeding of plants
2. Correlate the genetics behind breeding of crops
3. Comprehend breeding of crops
4. Exploit crops to express hybrid vigour
5. Realize the necessity of protecting farmers and breeders rights
6. Practice hybridization and plan breeding experiments

Module:1	**Introduction to Plant Breeding**	**4 hours**
Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Domestication, acclimatization and plant introduction. Centres of origin.		
Module:2	**Genetic basis**	**3 hours**
Genetics in relation to plant breeding. Components of genetic variation, heritability and genetic advance. Concepts of population genetics and Hardy-Weinberg Law.		
Module:3	**Reproduction**	**3 hours**
Modes of reproduction, apomixes, self-incompatibility, genetic consequences of male sterility and cultivar options.		
Module:4	**Breeding of self-pollinated crops**	**3 hours**
Mass and pure line selection, hybridization techniques and handling of segregating population. Multiline concept.		
Module:5	**Breeding of cross pollinated & asexually propagated crops**	**5 hours**
Modes of selection. Population improvement schemes: Ear to row method, modified ear to row and recurrent selection schemes. Development of inbred lines, hybrids, composite and synthetic varieties. Clonal selection and hybridization.		
Module:6	**Heterosis and important breeding methods**	**7 hours**

Heterosis and inbreeding depression. Wide hybridization. Polyploidy in relation to plant breeding. Mutation breeding methods and uses. Breeding for important biotic and abiotic stresses. Pre-breeding. Maintenance of breeding records and data collection.		
Module:7	**Biotechnology and IPR in Crop Improvement**	**5 hours**
DNA markers and marker assisted selection. Participatory plant breeding. Intellectual Property Rights and patenting. Plant Breeders and & Farmers Rights.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**32**
Text Books		
1.	Singh, B.D. Plant Breeding principles and methods. 2022. 12th edition, MedTech Science Press, India.	
2.	Prasad, B.K. and B.D. Singh. Objective Plant breeding. 2020. Kalyani Publishers, India.	
Reference Books		
1.	George Acquaah. Principles of Plant Genetics and Breeding, 2020. 3rd edition. Wiley-Blackwell, USA.	
2.	Ramakrishna Chintakunta and M. Geethavani. A Textbook of Intellectual Property Rights, 2022, Blue Hill Publications, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Plant Breeders kit	**2.5 hours**
2.	Study of germplasm of various crops	**2.5 hours**
3.	Methods of calculating mean, range, variance and standard deviation	**2.5 hours**
4.	Designs of field experiments: Completely Randomized Design (CRD)	**2.5 hours**
5.	Randomized Complete Block Design and calculation of heritability	**2.5 hours**
6.	Study of male sterility system	**2.5 hours**
7.	Prediction of performance of double cross hybrids	**2.5 hours**
8.	Simple problems in population genetics	**2.5 hours**
9.	Consequences of inbreeding on genetic structure of resulting populations	**2.5 hours**
10.	Handling of segregation populations	**2.5 hours**
11.	Synthetics	**2.5 hours**
12.	To work out the mode of pollination in a given crop and extent of natural out-crossing.	**2.5 hours**
13.	Floral Structure, emasculation and hybridization techniques in self-pollinated crops- Cereals	**2.5 hours**
14.	Floral Structure, emasculation and hybridization techniques in self-pollinated crops- Pulses and oilseeds	**2.5 hours**
15.	Floral Structure, emasculation and hybridization techniques in cross pollinated crops- Cereals	**2.5 hours**
16.	Floral Structure, emasculation and hybridization techniques in cross pollinated crops- Pulses and oilseeds	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		

1.	Singh, B.D. Plant Breeding principles and methods. 2022. 12th edition, MedTech Science Press, India.
Reference Books	
1.	George Acquaah. Principles of Plant Genetics and Breeding, 2020. 3rd edition. Wiley-Blackwell, USA.
2.	Phundan Singh. Essentials of Plant Breeding. 2023. Kalyani Publishers, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Principles of Seed Technology**	**L**	**T**	**P**	**C**
GPBAG203		**1**	**0**	**4**	**3**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Demonstrating the fundamentals of seed technology
2. Extending the practical knowledge on seed production
3. Imparting knowledge on seed certification, processing, storage and marketing

Expected Course Outcome: At the end of the course the student should be able to

1. Comprehend seed production and seed quality
2. Demonstrate the concepts of seed certification
3. Validate the concepts Seed Act and seed testing processes
4. Understand seed processing and seed storage techniques
5. State the norms of seed marketing in India.
6. Apply knowledge gained to commercially produce seeds and practice seed testing

Module:1	**Seed Technology: Seed Quality**	**2 hours**

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control. Maintenance of genetic purity during seed production. Seed quality: definition, characters of good quality seed and different classes of seed.

Module:2	**Seed production of major crops**	**3 hours**

Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.

Module:3	**Seed certification and Act**	**2 hours**

Seed certification, phases of certification, procedure for seed certification and field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983.

Module:4	**Varietal identification**	**2 hours**

Varietal Identification through grow out test and electrophoresis, molecular and biochemical test. Detection of genetically modified crops, transgene contamination in non-GM crops, GM crops and organic seed production.

Module:5	**Seed processing and seed testing**	**2 hours**

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing.

Module:6	**Seed storage**	**2 hours**

Seed storage: general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.		
Module:7	**Seed marketing**	**2 hours**
Seed marketing: structure and organization, sales generation activities and promotional media. Factors affecting seed marketing and Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.		
Module:8	**Contemporary Issues**	**1 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**16**

Text Books	
1.	Khare, D. Principles of Seed Technology. 2019. Scientific Publishers, New Delhi.
2.	Sen, S and Gosh N. Seed Science and Technology, 2018. Kalyani Publishers, India.
Reference Books	
1.	Gaur, S.C. A handbook of seed processing and marketing. 2012. Agrobios, India.
2.	Vanangamudi, K., S. Kavitha and K. Raja, Objective Seed Science and Technology, 2017. Scientific Publishers, New Delhi. India.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Seed production in major cereals: Rice	**5 hours**
2.	Seed production in major cereals: Wheat	**5 hours**
3.	Seed production in major cereals: Maize and Sorghum	**5 hours**
4.	Seed production in major cereals: Bajra and Ragi	**5 hours**
5.	Seed production in major pulses: Redgram	**5 hours**
6.	Seed production in major pulses: Blackgram and green gram	**5 hours**
7.	Seed production in major oilseeds: Sunflower	**5 hours**
8.	Seed production in major oilseeds: Groundnut	**5 hours**
9.	Seed production in important vegetable crops: Tomato, Brinjal and chilli	**5 hours**
10.	Seed production in important vegetable crops: Cucurbitaceous	**5 hours**
11.	Seed sampling and testing: Physical purity and Germination	**5 hours**
12.	Seed sampling and testing: Viability	**5 hours**
13.	Seed and seedling vigour test.	**5 hours**
14.	Genetic purity test: Grow out test and electrophoresis.	**5 hours**
15.	Seed certification: Procedure, field inspection and preparation of field inspection report.	**5 hours**
16.	Visit to seed production farms, seed testing laboratories and seed processing plant.	**5 hours**
	Total Laboratory Hours:	**80**

Text Books	
1.	Sumati Narayan, Rajeev Kumar, Sushil Kumar Swarnkar and Sunil Kumar Singh. A Text Book of Seed Technology, 2016. Kalyani Publishers, India
2.	K. Vanangamudi. Seed Science and Technology: An Illustrated Textbook, 2020.

	New India Publishing Agency, India.			
Reference Books				
1.	Prabahar Singh, B.S.Asati. Seed production technology of vegetables. Daya publishing house, 2015. New Delhi			
2.	Renugadevi. Handbook of Seed Testing. 2020. Agrobios. India			
Mode of Evaluation: Internal assessments and Final assessment test				
Recommended by Board of Studies	28-02-2024			
Approved by Academic Council	No.73	**Date**	14-03-2024	

Course Code	**Crop Improvement – I (Kharif Crops)**	**L**	**T**	**P**	**C**
GPBAG305		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
GPBAG202	Fundamentals of Plant Breeding	1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the use of genetic resources
2. Describing concepts of breeding crops based on objectives
3. Teaching hybrid seed production techniques and modern breeding concepts

Course Outcomes: At the end of the course the student should be able to

1. Infer the importance of plant genetic resources and utilize it in crop improvement
2. Design crop specific breeding methodology
3. Comprehend breeding methods specific to an objective
4. Describe hybrid seed production of various Kharif crops
5. Examine the reproductive characteristics of kharif crops
6. Practice hybridization and plant breeding

Module:1	**The origin and distribution of crop species**	**2 hours**
Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops		
Module:2	**Overview of plant genetic resources.**	**2 hours**
Plant genetic resources, its utilization and conservation		
Module:3	**Qualitative and quantitative genetics**	**3 hours**
Study of genetics of qualitative and quantitative characters.		
Module:4	**Plant breeding concepts**	**2 hours**
Important concepts of breeding self- pollinated, cross pollinated and vegetatively propagated kharif crops.		
Module:5	**Crop improvement**	**2 hours**
Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality including physical, chemical and nutritional quality.		
Module:6	**Hybrid seed production**	**2 hours**
Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea.		
Module:7	**Recent breeding concepts**	**2 hours**
Ideotype concept and climate resilient crop varieties for future.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by industrial expert		

	Total Lecture hours:	**16**
Text Books		
1.	Singh, B.D. Plant breeding principles and methods. 2022. 12th edition, Kalyani Publishers, India	
2.	Phundan, S. Principles of Plant Breeding. 2020. Kalyani Publishers, India.	
Reference Books		
1.	Stoskopf, N.C., Dwight T. T., and Christie, B.R. Plant breeding: theory and practice. 2019. 1st edition, CRC Press, Boca Raton, Florida, United States.	
2.	Narkhede, G.W. and Thakur N.R., Genetics and Plant Breeding (Glossary). 2023. Lambert Academic Publishing, London, UK.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice and jute	**2.5 hours**
2.	Floral biology, emasculation and hybridization techniques in Maize and sorghum	**2.5 hours**
3.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Pearl millet and ragi	**2.5 hours**
4.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Urdbean and mung bean	**2.5 hours**
5.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Soybean and groundnut	**2.5 hours**
6.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Cowpea, sesame and castor	**2.5 hours**
7.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Cotton and tobacco	**2.5 hours**
8.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Brinjal and okra	**2.5 hours**
9.	Floral biology, emasculation and hybridization techniques in cucurbitaceous crops	**2.5 hours**
10.	Maintenance breeding of different kharif crops	**2.5 hours**
11.	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods	**2.5 hours**
12.	Study of field techniques for seed and hybrid seeds production in Kharif crops	**2.5 hours**
13.	Estimation of heterosis, inbreeding depression and heritability	**2.5 hours**
14.	Layout of field experiments and trials	**2.5 hours**
15.	Study of quality characters, donor parents for different characters	**2.5 hours**
16.	Visit to seed production plots; Visit to AICRP plots of different field crops	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Sharma, D., Singh, S., Sharma, S.K. and Singh, R. Smart Plant Breeding for Field Crops in Post-genomics Era. 2023. 1st edition, Springer Nature, Singapore.	
Reference Books		
1.	Gupta, S.K. Practical Plant Breeding. 2019. 2nd edition, M/s Agrobios, India.	

2.	Phundan Singh, S.S.N. Biometrical techniques in plant breeding.2021, Kalyani publishers, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course Code	**Crop Improvement – II (Rabi Crops)**	**L**	**T**	**P**	**C**
GPBAG306		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
GPBAG202	Fundamentals of Plant Breeding	1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the use of genetic resources
2. Describing concepts of breeding crops based on objectives
3. Teaching hybrid seed production techniques and modern breeding concepts

Course Outcomes: At the end of the course the student should be able to

1. Infer the importance of plant genetic resources and utilize it in crop improvement
2. Design crop specific breeding methodology
3. Comprehend breeding methods specific to an objective
4. Describe hybrid seed production of various rabi crops
5. Study the floral biology of rabi crops
6. Practice hybridization and plant breeding

Module:1	**The origin and distribution of crop species**	**2 hours**
Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops		
Module:2	**Overview of plant genetic resources.**	**2 hours**
Plant genetic resources, its utilization and conservation		
Module:3	**Qualitative and quantitative genetics**	**3 hours**
Study of genetics of qualitative and quantitative characters.		
Module:4	**Plant breeding concepts**	**2 hours**
Important concepts of breeding self- pollinated, cross pollinated and vegetatively propagated rabi crops.		
Module:5	**Crop improvement**	**2 hours**
Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality including physical, chemical and nutritional quality.		
Module:6	**Hybrid seed production**	**2 hours**
Hybrid seed production technology of rabi crops.		
Module:7	**Recent breeding concepts**	**2 hours**
Ideotype concept and climate resilient crop varieties for future.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by industrial expert		
	Total Lecture hours:	**16**

Text Books

1.	Chaudhary, A.K. and Chaudhary, R.C. Plant Breeding (As per the Dean's Committee of ICAR and New Education Policy). 2022. 1st edition, S.R Scientific

	Publishers, India.	
2.	Qureshi, A, M, I., Dar, Z.A. and Wani, S.H. Quality Breeding in Field Crops. 2019. 1st edition, Springer, Switzerland.	
Reference Books		
1.	Stoskopf, N.C., Dwight T. T. and Christie, B.R. Plant breeding: theory and practice. 2019. 1st edition, CRC Press, Boca Raton, Florida, United States.	
2.	Priyadarshan, P.M. Plant Breeding: Classical to Modern. 2019. Springer Nature, Singapore.	
3.	Singh, B.D. Plant Biotechnology. 2022. 4th edition. Medtech Science Press; India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Wheat and barley	**2.5 hours**
2.	Floral biology, emasculation and hybridization techniques in Oats and chickpea	**2.5 hours**
3.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Lentil and field pea	**2.5 hours**
4.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Rajma and horse gram	**2.5 hours**
5.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Rapeseed and Mustard	**2.5 hours**
6.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Sunflower and safflower	**2.5 hours**
7.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Potato, and berseem	**2.5 hours**
8.	Floral biology, emasculation and hybridization techniques in different crop species; viz., Sugarcane and tomato,	**2.5 hours**
9.	Floral biology, emasculation and hybridization techniques in chilli and onion	**2.5 hours**
10.	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods	**2.5 hours**
11.	Study of field techniques for seed and hybrid seeds production in rabi crops	**2.5 hours**
12.	Estimation of heterosis and its implementation in plant breeding	**2.5 hours**
13.	Estimation of inbreeding depression and heritability	**2.5 hours**
14.	Layout of field experiments and trials	**2.5 hours**
15.	Study of quality characters, donor parents for different characters	**2.5 hours**
16.	Visit to seed production plots; Visit to AICRP plots of different field crops	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Sharma, D., Singh, S., Sharma, S.K. and Singh, R. Smart Plant Breeding for Field Crops in Post-genomics Era. 2023. 1st edition, Springer Nature, Singapore.	

Reference Books				
1.	Gupta, S.K. Practical Plant Breeding. 2019. 2nd edition, M/s Agrobios, India.			
2.	Phundan, S. and Narayanan, S.S. Biometrical techniques in plant breeding.2021, Kalyani publishers, India.			
Mode of Evaluation: Internal assessments and Final assessment test				
Recommended by Board of Studies	28-02-2024			
Approved by Academic Council	No.73	**Date**	14-03-2024	

Soil Science & Agricultural Chemistry							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
SACAG101	Fundamentals of Soil Science	Embedded T & L	2	0	2	3	None
SACAG202	Problematic Soils and their Management	Theory	2	0	0	2	SACAG101
SACAG303	Manures, Fertilizers and Soil Fertility Management	Embedded T & L	2	0	2	3	SACAG101

Course code	**Fundamentals of Soil Science**	**L**	**T**	**P**	**C**
SACAG101		**2**	**0**	**2**	**3**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Describing the fundamental concepts of soil science
2. Imparting the knowledge on soil properties and soil water plant relationship
3. Stating the various aspects of soil science and substantiating through experiments

Expected Course Outcome: At the end of the course the student should be able to

1. Acquire knowledge on the importance of soil to agriculture
2. Value the physical properties of soil
3. Classify soil type, soil texture and soil structure required for an agricultural field
4. Analyze soil, water and nutrients related to crop growth
5. State techniques to mitigate soil pollution
6. Identify soil related problems in agricultural fields and provide suitable solutions

Module:1	**Soil in perspective**	**6 hours**
Soil as a natural body. Pedological and edaphological concepts of soil. Genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation. Soil profile and components of soil.		
Module:2	**Physical Properties**	**4 hours**
Soil texture, structure, density, porosity, colour, consistency and plasticity.		
Module:3	**Taxonomy**	**8 hours**

Soil taxonomy classification and soils of India. Soil water retention, movement and availability. Soil air, composition, gaseous exchange, problems and plant growth. Soil temperature: source, amount and flow of heat in soil and its effect on plant growth.		
Module:4	**Reaction and Colloids**	**4 hours**
Soil pH, acidity, alkalinity, buffering and effect of pH on nutrient availability. Soil colloids: inorganic and organic. Silicate clays: constitution and properties. Sources of charge: ion exchange, cation exchange capacity and base saturation.		
Module:5	**Soil organic matter:**	**4 hours**
composition, properties and its influence on soil properties. Humic substances - nature and properties.		
Module:6	**Soil Organisms**	**2 hours**
Macro and micro soil organisms, their beneficial and harmful effects		
Module:7	**Soil pollution**	**2 hours**
Behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**

Text Books	
1.	Mahendru Kumar Gautam, Dr. Ravindra Sachan, Dr. Devendra Singh, Dr. Anil Kumar. Fundamentals of Soil Science (Laboratory Manual of Soil Analysis). 2023. Bhavya Books, India.
2.	Vijay Kumar, Rakesh Kumar. Practical Manual of Soil Science (Soil Physics, Soil Fertility and Soil Carbon Analysis). 2018. Brillion Publishing, India.
Reference Books	
1.	HenryD. Foth. Fundamentals of Soil Science. 8th Edition. 1990. John Wiley& Sons. USA.
2.	Soil Science-An Introduction. 2015. Indian Society of Soil Science. India.
Mode of Evaluation: Assignment, Mid semester and Final Assessment Test	
Indicative Experiments	

1.	Study of soil profile under field conditions	**2.5 hours**
2.	Identification of glasswares and laboratory rules	**2.5 hours**
3.	Preparation of standard solution and standardization (Concept of normality, molarity, molality, ppm)	**2.5 hours**
4.	Study of soil sampling tools, collection of representative soil sample, its processing and storage.	**2.5 hours**
5.	Study of soil forming rocks and minerals.	**2.5 hours**
6.	Determination of soil density and porosity.	**2.5 hours**
7.	Determination of soil moisture by dry oven method	**2.5 hours**
8.	Determination of soil texture by feel method	**2.5 hours**
9.	Determination of soil texture by feel and Bouyoucos Methods	**2.5 hours**
10.	Studies of capillary rise phenomenon of water in soil column and water movement in soil	**2.5 hours**
11.	Determination of soil pH and electrical conductivity	**2.5 hours**
12.	Determination of cation exchange capacity of soil	**2.5 hours**
13.	Determination of soil colour	**2.5 hours**

14.	estimation of organic matter content of soil.	**2.5 hours**
15.	Study of soil map	**2.5 hours**
16.	Demonstration of heat transfer in soil	**2.5 hours**
	Total Laboratory Hours	**40**

Text Books	
1.	Mahendru Kumar Gautam, Dr. Ravindra Sachan, Dr. Devendra Singh, Dr. Anil Kumar. Fundamentals of Soil Science (Laboratory Manual of Soil Analysis). 2023. Bhavya Books, India.
2.	Vijay Kumar, Rakesh Kumar. Practical Manual of Soil Science (Soil Physics, Soil Fertility and Soil Carbon Analysis). 2018. Brillion Publishing, India.
Reference Books	
1.	HenryD. Foth. Fundamentals of Soil Science. 8th Edition. 1990. John Wiley& Sons. USA.
2.	Soil Science-An Introduction. 2015. Indian Society of Soil Science. India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Problematic Soils and their Management**	**L**	**T**	**P**	**C**
SACAG202		**2**	**0**	**0**	**2**
Pre-requisite		**Syllabus version**			
SACAG101	Fundamentals of Soil Science	1.0			

Course Objectives: The course is aimed at

1. Providing knowledge on soil and water quality for agricultural use
2. Describing constraints and management of problematic soils
3. Imparting knowledge on problematic soils through remote sensing and GIS

Expected Course Outcome: At the end of the course the student should be able to

1. Comprehend the scenario of waste land and problem soils in India; Understand reclamation of problematic soils
2. Acquire knowledge on water quality; State the role of remote sensing and GIS in diagnosis of problematic soils
3. Understand the remediation of soils under different agro-ecosystems; Explain management of problematic soils

Module:1	**Soil health**	**2 hours**
Soil quality and health		
Module:2	**Problem soils in India**	**6 hours**
Distribution of waste land and problem soils in India and their categorization based on properties.		
Module:3	**Chemical Problematic soil**	**4 hours**
Reclamation and management of saline and sodic soils, acid soils, acid Sulphate soils, eroded and compacted soils, flooded soils and polluted soils.		
Module:4	**Physical Problematic soil**	**4 hours**
Reclamation and management of eroded and compacted soils, flooded soils and polluted soils.		
Module:5	**Water quality**	**4 hours**

Irrigation water: quality and standards, utilization of saline water in agriculture.		
Module:6	**Remote sensing and GIS**	**4 hours**
Remote sensing and GIS in diagnosis and management of problem soils.		
Module:7	**Land Capability**	**6 hours**
Land capability and classification. Land suitability classification. Problematic soils under different Agro-ecosystems. Multipurpose tree species, bio remediation of problematic soils through MPTs.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**

Text Book	
1	Weil, R. R and N.C. Brady. The Nature and Properties of Soils, 15th edition. 2017. Pearson, UK.
2.	Dilip Kumar Das, Problematic Soils and Their Management. 2019. Kalyani Publishers, India.
3.	Manorama Thampatti. Problem Soils Constraints and Management. 2023. CRC press, USA.
Reference Books	
1.	Biswas. T.D and S.K. Mukherjee. Text book of Soil Science, 2nd edition. 2017. McGraw- Hill Education. USA.
3.	Mehra, R.K. Textbook of Soil Science. 2016. ICAR, New Delhi, India.

Mode of Evaluation: Assignment, Mid semester and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Manures, Fertilizers and Soil Fertility Management**	**L**	**T**	**P**	**C**
SACAG303		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
SACAG101	Fundamentals of Soil Science	1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on soil manures and fertilizers
2. Providing a clear understanding on nutrient application and its management
3. Describing basic concepts of soil fertility, soil chemistry and its response to plants

Expected Course Outcome: At the end of the course the student should be able to

1. Comprehend the utility of manures
2. Interpret the importance of varied forms of plant fertilizers
3. Interpret deficiency and toxicity symptoms of nutrients in plants
4. Describe fertility status of soil
5. Deduce fertilizer application methods based on plant and soil analysis
6. Estimate plant and soil nutrients and provide recommendations

Module:1	**Organic manures**	**6 hours**
Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management		

Module:2	**Chemical fertilizers**	**4 hours**
Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic and potassic fertilizers. Secondary and micronutrient fertilizers, complex fertilizers and nano fertilizers. Soil amendments. Fertilizer Storage. Fertilizer Control Order		
Module:3	**Plant Nutrients**	**4 hours**
History of soil fertility and plant nutrition. Criteria of essentiality, role, deficiency and toxicity symptoms of essential plant nutrients.		
Module:4	**Nutrient uptake mechanism**	**4 hours**
Mechanisms of nutrient transport to plants and factors affecting nutrient availability to plants		
Module:5	**Chemistry of soil nutrients and Soil fertility evaluation**	**6 hours**
Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation. Soil testing. Critical levels of different nutrients in soil		
Module:6	**Soil nutrients**	**4 hours**
Forms of nutrients in soil. Methods of fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE).		
Module:7	**Plant analysis**	**2 hours**
Plant analysis and rapid plant tissue tests. Indicator plants. Methods of nutrient application under rainfed and irrigated conditions.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**
Text Books		
1.	Ranjan Kumar Basak. Fertilizers: A Text Book. 4th edition, 2016. Kalyani publishers, India.	
2.	Havlin, J.L., Tisdale, S.L., Nelson, W.L. and J.D. Beaton. Soil Fertility and Fertilizers. 8th edition, 2016. Pearson Education, India.	
Reference Books		
1.	Soil Science: An Introduction. 2015. Indian Society of Soil Science (ISSS). India.	
2.	Das, D.K. Introductory Soil Science. 4th edition, 2015. Kalyani Publishers, India.	
Mode of Evaluation: Assignment, Mid semester and Final Assessment Test		
Indicative Experiments		
1.	Soil sample techniques	**2.5 hours**
2.	Introduction of analytical instruments and their principles, calibration and applications	**2.5 hours**
3.	Colorimetry and flame photometry.	**2.5 hours**
4.	Estimation of soil organic carbon	**2.5 hours**
5.	Estimation of alkaline hydrolysable N in soils.	**2.5 hours**
6.	Estimation of soil extractable P in soils.	**2.5 hours**
7.	Estimation of exchangeable K	**2.5 hours**
8.	Estimation of exchangeable Ca in soils	**2.5 hours**
9.	Estimation of exchangeable Mg in soils	**2.5 hours**
10.	Estimation of soil extractable S in soils	**2.5 hours**

11.	Estimation of potassium in Muraite of Potash/Sulphate of Potash by flame photometer.	**2.5 hours**
12.	Estimation of DTPA extractable Zn in soils	**2.5 hours**
13.	Estimation of N in plants	**2.5 hours**
14.	Estimation of P in plants	**2.5 hours**
15.	Estimation of K in plants	**2.5 hours**
16.	Estimation of Sin plants	**2.5 hours**
	Total Laboratory Hours	**40**
Text Books		
1.	Harikesh and Sanjay Kumar. Practical Manual for Manures, Fertilizers and Plant Analysis. 2018. AkiNik Publications, India.	
2.	Javid Ahmad Sofi, Shabir, A.B. and majeed, U.H.C. Practical Manual for Analysis of Soil Water Fertilizer and Manure. 2020. Daya Publishing House, India.	
Reference Books		
1.	Soil Science - An Introduction. 2018. Indian Society of Soil Science. India.	
2.	Dhyan Singh, P.K. Chhonkar and B.S. Dwivedi. Manual on soil, plant and water analysis. 2017. Westvill Publishing House, India.	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28/02/2024	
Approved by Academic Council	No. 73 **Date**	14/03/2024

Entomology							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
AENAG101	Fundamentals of Entomology	Embedded T & L	3	0	2	4	None
AENAG302	Pests of Crops and Stored Grains and their Management	Embedded T & L	2	0	2	3	AENAG101
AENAG303	Management of Beneficial Insects	Embedded T & L	1	0	2	2	AENAG101

Course code	**Fundaments of Entomology**	**L**	**T**	**P**	**C**
AENAG101		**3**	**0**	**2**	**4**
Pre-requisite	None	**Syllabus version**			
		1.0			
Course Objectives: The course is aimed at					
1. Providing deeper understanding on the biology of insects 2. Imparting knowledge on evolutionary relationships of insect orders and families 3. Describing insect life cycle, morphology and adaptation to a wide variety of natural environments by taking students on field trips and collecting insects					

Expected Course Outcome: At the end of the course the student should be able to

1. Express knowledge gained on the historic contributions of eminent scientists in the field of entomology and fascinating facts about insects
2. Describe insect's anatomy and morphology
3. Infer biochemical and physiological processes of insect metabolism and growth
4. Relate ecological relationships of insects with other life forms
5. Devise pest control measures
6. Identify insects based on their key taxonomic characters

Module:1	**History and Importance of Insecta**	**4 hours**
History of Entomology in India: Contributions of eminent entomologists, locations and year of establishment of entomological institutions. Major points related to dominance of Insecta in animal kingdom. Contributory factors for abundance of insects-structural, developmental and protective characters and construction of protected niches of Insecta.		
Module:2	**Phylum Arthropoda: Classification and Morphology**	**6 hours**
Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, wing venation, modifications and wing coupling apparatus		
Module:3	**Metamorphosis and Organ Systems**	**8 hours**
Metamorphosis and diapause in insects. Types of larvae and pupae. Structure of male and female genital organ. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.		
Module:4	**Insect Ecology**	**4 hours**
Introduction, environment and its components. Effect of abiotic factors: temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors: food competition, natural and environmental resistance.		
Module:5	**IPM and classification of Insecticides**	**8 hours**
Categories of pests. Concept of IPM. Practices, scope and limitations of IPM. Classification, formulations and toxicity of insecticides. Chemical control, importance, hazards and limitations. Recent methods of pest control, repellents, anti-feedants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.		
Module:6	**Insect Systematics I**	**8 hours**
Taxonomy, importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera. Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae.		
Module:7	**Insect Systematics II**	**8 hours**
Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera:Pieridae, Papiloinidae,		

Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae.		
Module:8	**Contemporary Issues**	**2 hours**
Visit to an insect Museum / Lecture by Industrial Expert		
	Total Lecture hours:	**48**
Text Book		
1.	Pedigo, L. P., Rice, M. E., and Krell, R. K. Entomology and pest management. 2021. Waveland Press.	
Reference Books		
1.	Timbhare, D.B. Modern Entomology, 2015. Himalaya Publishing House. India.	
2.	Vasantharaj David, B. and Rama Murthy V.V. Elements of Economic Entomology, 2016. Popular Book Depot, Coimbatore, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Methods of collection and preservation of insects including immature stages	**2.5 hours**
2.	Observations on external features of Grasshopper	**2.5 hours**
3.	Study of different types of insect antenna and legs	**2.5 hours**
4.	Study of types of mouthparts – biting and chewing, piercing and sucking, rasping and sucking, chewing and lapping, sponging and siphoning	**2.5 hours**
5.	Study of wing venation, types of wings and wing coupling mechanisms	**2.5 hours**
6.	Study of different types of insect egg, larva and pupa	**2.5 hours**
7.	Study of insect digestive system	**2.5 hours**
8.	Study of insect male and female reproductive system	**2.5 hours**
9.	Study of characters of orders and their families of agricultural importance - Orthoptera, Dictyoptera, Odonata	**2.5 hours**
10.	Study of characters of orders and their families of agricultural importance - Neuroptera, Isoptera and Lepidoptera	**2.5 hours**
11.	Study of characters of orders and their families of agricultural importance – Thysanoptera and Hemiptera	**2.5 hours**
12.	Study of characters of orders and their families of agricultural importance – Coleoptera, Diptera	**2.5 hours**
13.	Study of characters of orders and their families of agricultural importance – Hymenoptera	**2.5 hours**
14.	Sampling techniques for estimation of insect population and damage	**2.5 hours**
15.	Insecticides and their formulations. Pesticide appliances and their maintenance.	**2.5 hours**
16.	Visit to a insect museum	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	McGavin, G. C., & Davranoglou, L. R. Essential entomology. 2023. Oxford University Press.	

Reference Books			
1.	Sanjayan, K. P. Insect Physiology, 21st Century Biology and Agriculture: Textbook Series. 2018. Scientific Publishers, India.		
2.	Awasthi, V. B. Introduction to general and applied entomology. 2016. Scientific Publishers, India.		
Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Pests of Crops and Stored Grains & their Management**	**L**	**T**	**P**	**C**
AENAG302		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
AENAG101	Fundamentals of Entomology	1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on pest management in agricultural and horticultural crops
2. Providing information on optimal insecticides application and fumigation practices
3. Demonstrating management of insect pests in stored grain ecosystems

Expected Course Outcome: At the end of the course the student should be able to

1. Identify major pests of field crops and comprehend their management practices
2. Acquire knowledge on pest management in fruit crops
3. Explain the methods of pest identification and their management in vegetables
4. Demonstrate damage symptoms caused by insect pests and their management in plantation, garden, narcotic, spice and condiment crops
5. Comprehend grain store management
6. Assess losses due to insect pests in crops and recommend control measures

Module:1	**Pests of Cereals, Millets and Pulses**	**4 hours**

General account on nature and type of damage caused by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices of other important arthropod pests of various cereals, millets and pulses

Module: 2	**Pests of Oilseeds, Cotton, Sugarcane and Green manures**	**4 hours**

General account on nature and type of damage caused by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices of other important arthropod pests of oilseeds, cotton, sugarcane and green manure crops.

Module:3	**Fruit crop pests and their management**	**5 hours**

Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices of other important arthropod pests of various fruit crops

Module:4	**Vegetable crop pests and their management**	**5 hours**

Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices of other important

arthropod pests of various vegetable crops		
Module:5	**Pests of plantation crops and spices**	**3 hours**
Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices of other important arthropod pests of various plantation crops and spices		
Module: 6	**Pests of flowers and medicinal crops**	**3 hours**
Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices of other important arthropod pests of various flowers and medicinal crops		
Module:7	**Pest management in stored grain ecosystem**	**6 hours**
Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management		
Module: 8	**Contemporary issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**
Text Book		
1.	Reddy, P.P. Insect, mite and vertebrate pests and their management in horticultural crops. 2017. Scientific Publishers, India.	
Reference Books		
1.	David, B.V. and V.V. Ramamurthy. Elements of Economic Entomology 8th Edition. 2016. Brillion Publishing, India.	
2.	Regupathy, A. and R. Ayyasamy. A guide on crop pests. 6th edition, 2016. Namrutha Publications, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Identification and study of life cycle and seasonal history of various insect pests attacking Cereals, Millets and Pulses	**2.5 hours**
2.	Identification and study of life cycle and seasonal history of various insect pests attacking Cotton, Oilseeds and Sugarcane	**2.5 hours**
3.	Identification and study of life cycle and seasonal history of various insect pests attacking Tomato, Bhendi and Brinjal	**2.5 hours**
4.	Identification and study of life cycle and seasonal history of various insect pests attacking Chilli, Crucifers and Cucurbits	**2.5 hours**
5.	Identification and study of life cycle and seasonal history of various insect pests attacking Mango, Guava, Pomegranate and Sapota	**2.5 hours**
6.	Identification and study of life cycle and seasonal history of various insect pests attacking Apple, Papaya, Grapes, Citrus and Banana	**2.5 hours**
7.	Identification and study of life cycle and seasonal history of various insect pests attacking Onion, Garlic, Turmeric, Pepper and Cardamom	**2.5 hours**
8.	Identification and study of life cycle and seasonal history of various insect pests attacking Coconut, Rose and Jasmine	**2.5 hours**
9.	Visit to nearest farmers field for insect pest collection	**2.5 hours**

10.	Identification of insect pests and mites associated with stored grains	**2.5 hours**
11.	Determination of insect infestation by different methods. Assessment of losses due to insects	**2.5 hours**
12.	Calculations on the doses of insecticides application techniques	**2.5 hours**
13.	Fumigation techniques of grain store/ godown	**2.5 hours**
14.	Identification of rodents and birds and their control operations in godowns	**2.5 hours**
15.	Methods of grain sampling under storage condition and determination of moisture content of grain	**2.5 hours**
16.	Visit to nearest Food Corporation of India godowns	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Book	
1.	Reddy, P.P. 2017. Insect, mite and vertebrate pests and their management in horticultural crops. Scientific Publishers, India.
Reference Books	
1.	David, B.V. and V.V. Ramamurthy. 2016. Elements of Economic Entomology 8th Edition. Brillion Publishing, India.
2.	Regupathy, A. and R. Ayyasamy. 2016. A guide on crop pests. 6th edition, Namrutha Publications, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Management of Beneficial Insects**	**L**	**T**	**P**	**C**
AENAG303		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
AENAG101	Fundamentals of Entomology	1.0			

Course Objectives: The course is aimed at

1. Instructing on production techniques involved in beekeeping and silkworm rearing
2. Describing lac products and production techniques
3. Imparting knowledge on biological control of insect pests using natural enemies.

Expected Course Outcome: At the end of the course the student should be able to

1. Acquire knowledge on honeybee species and apiary management
2. Understand mulberry cultivation and silkworm rearing techniques
3. Comprehend lac culture and their products
4. Acquire knowledge on biological control of insect pests
5. Recommend package of practices for rearing honeybee, silkworm and lac
6. Endorse package of practices for silkworm and lac

Module:1	**Bee keeping**	**2 hours**

Importance of beneficial insects, beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management

Module:2	**Bee behaviour**	**2 hours**

Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Module:3	**Species and races of silkworms**	**2 hours**
Types of silkworm, voltinism and biology of silkworm. Pest and diseases of silkworm, management		
Module:4	**Rearing of silkworms**	**3 hours**
Rearing appliances of mulberry silkworm and methods of disinfection. Rearing, mounting and harvesting of cocoons. Mulberry cultivation		
Module:5	**Lac culture**	**2 hours**
Species of lac insect, morphology, biology and host plant. Lac production- seed lac, button lac, shellac and lac- products.		
Module:6	**Biological control of insect pests**	**3 hours**
Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques.		
Module:7	**Pollinators, weed killers and scavengers**	**1 hour**
Important species of pollinator, weed killers and scavengers with their importance.		
Module:5	**Contemporary Issues**	**1 hour**
Lecture by industrial expert		
	Total Lecture hours:	**16**

Text Books	
1.	David, B.V. and V.V. Ramamurthy. Elements of Economic Entomology 8th Edition. 2016. Brillion Publishing, India.
2.	Ragumoorthy, K.N., M.R. Srinivasan, V. Balasubramanian and N. Natarajan. Principles of Applied Entomology, 2016. Ae Publications. India.
Reference Books	
1.	David V. Alford. 2019. Beneficial Insects. CRC Press, USA.
2.	Opender Koul and G.S. Dhaliwal. Predators and Parasitoids. 2019. CRC Press, USA.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Identification, morphology and structural adaptations in honey bees	**2.5 hours**
2.	Apiary equipment, honey extraction and wax processing	**2.5 hours**
3.	Visit to apiary	**2.5 hours**
4.	Apiary management techniques	**2.5 hours**
5.	Identification of bee diseases and enemies	**2.5 hours**
6.	Mulberry nursery bed preparation - methods of planting - Pruning methods - leaf / shoot harvest - preservation of leaves	**2.5 hours**
7.	Identification of damage symptoms of insects, diseases and nematodes of mulberry	**2.5 hours**
8.	Chawki rearing and shoot rearing	**2.5 hours**
9.	Silkworm rearing appliances	**2.5 hours**
10.	Identification of diseases and enemies of silkworm	**2.5 hours**
11.	Lac insect-life history, hosts and culturing of lac, natural enemies and lac products	**2.5 hours**
12.	Study of useful insects- Pollinators, weed killers, scavengers and soil builders	**2.5 hours**
13.	Identification and mass culturing of different types of parasitoids	**2.5 hours**

14.	Identification and mass culturing of different types of predators	**2.5 hours**
15.	Visit to research/ training institutions devoted to beekeeping, sericulture and lac culture	**2.5 hours**
16.	Visit to research/ training institutions devoted to natural enemies	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	David, B.V. and V.V. Ramamurthy. Elements of Economic Entomology 8th Edition. 2016. Brillion Publishing, India.	
2.	Ragumoorthy, K.N., M.R. Srinivasan, V. Balasubramanian and N. Natarajan. Principles of Applied Entomology, 2016. Ae Publications. India.	
Reference Books		
1.	David V. Alford. Beneficial Insects. 2019. CRC Press, USA.	
2.	Opender Koul and G.S. Dhaliwal. Predators and Parasitoids. 2019. CRC Press, USA.	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date**	14-03-2024

Agricultural Economics							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
AECAG101	Fundamentals of Agricultural Economics	Theory	2	0	0	2	None
AECAG202	Agricultural Finance and Co-operation	Embedded T & L	2	0	2	3	AECAG101
AECAG203	Agricultural Marketing Trade and Prices	Embedded T & L	2	0	2	3	AECAG202
AECAG305	Farm Management Production and Resource Economics	Embedded T & L	1	0	2	2	AECAG202

Course code	**Fundamentals of Agricultural Economics**	**L**	**T**	**P**	**C**
AECAG101		**2**	**0**	**0**	**2**
Pre-requisite	None				
	Syllabus version	1.0			
Course Objectives: The course is aimed at					
1. Imparting knowledge on the basics of economics. 2. Explaining on the factors of production and economy. 3. Enhancing the ability of analyzing economic models to facilitate creation of innovative ideas.					
Expected Course Outcome: At the end of the course the student should be able to					

1. Apply the knowledge gained on the fundamentals of economics and employ its applications in agriculture. 2. Interpret market structures responsible for creating national income. 3. Analyze and Integrate agro economic growth and knowledge to suggest policies.		
Module: 1	**Economics**	**6 hours**
Meaning, scope and subject matter. Definitions, activities and approaches to economic analysis. Micro and macroeconomics, positive and normative analysis. Nature of economic theory. Rationality assumption and concept of equilibrium. Economic laws as generalization of human behavior. Basic concepts: goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.		
Module: 2	**Agricultural Economics**	**2 hours**
Meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.		
Module: 3	**Demand and Supply**	**5 hours**
Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory, law of diminishing marginal utility and equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve and concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply and elasticity of supply.		
Module: 4	**Theory of Production and Costs**	**3 hours**
Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale. *Cost:* concepts, short run and long run cost curves.		
Module: 5	**Market Structure and National Income**	**6 hours**
Meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. Meaning and importance of national income, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.		
Module: 6	**Population, Money and Banking**	**4 hours**
Importance of population. Malthusian and optimum population theories. Natural and socioeconomic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems. Evolution, meaning and functions of money. Classification of money, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank and credit creation policy.		
Module: 7	**Public Finance, Taxation and Economic Systems**	**4 hours**
Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax:* meaning, direct and indirect taxes, agricultural taxation and VAT. *Economic systems:* Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies and elements of economic planning.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**

Text Book	
1	Subba Reddy S, P. Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi. Agricultural Economics, 2nd Revised edition, 2019. Oxford & IBH Co. Pvt. Ltd., India.
2.	Ashoka N, Shivanand Hongal, Harshavardhan M and Shashidhara N. Textbook of Agricultural Economics: Theory & Practices. 2023. Satish Serial Publishing House, India.
Reference Books	
1.	Edwin Griswold Nourse. Agricultural Economics: A Selection of Materials in which Economic Principles Are Applied to the Practice of Agriculture. 2017. CHIZINE PUBN. Canada.
2.	Amarjit Singh, A.N. Sadhu and Jasbir Singh. Fundamentals of Agricultural Economics 11th edition, 2022. Himalaya Publishing House, Mumbai, India.
Mode of Evaluation: Internal Assessment and Final Assessment Test	
Recommended by Board of Studies	28-02-2024
Approved by Academic Council	No.73 **Date** 14-03-2024

Course code	**Agricultural Finance and Co-operation**	**L**	**T**	**P**	**C**
AECAG202		**2**	**0**	**2**	**3**
Pre-requisite					
AECAG101	Fundamentals of Agricultural Economics				
	Syllabus version	1.0			

Course Objectives: The course is aimed at

1. Explaining the principles of agricultural finance and co-operation
2. Demonstrating the role of Indian institutions involved in farm financing
3. Outlining Indian co-operative credit movement and credit structures

Expected Course Outcome: At the end of the course the student should be able to

1. Explain on agricultural finance and credit.
2. Comprehend the role of sources involved in farm financing.
3. Assess financial statements and project reports
4. Describe the functionalities of co-operatives involved in farmers service
5. Clarify the role of national level cooperatives
6. Analyze the functions of a financial institute

Module:1	**Agricultural Finance**	**6 hours**
Meaning, scope, nature and significance. Credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need and classification. Credit analysis: 3 R's, and 5 C's of credits.		
Module:2	**Financing Institutions**	**4 hours**
Institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost.		
Module:3	**Sources of Agricultural Finance**	**2 hours**
An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India.		
Module:4	**Agricultural credit**	**6 hours**

Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements. Balance Sheet and Income Statement. Basic guidelines for preparation of project reports. Bank norms. SWOC analysis.		
Module:5	**Agricultural Co-operation**	**3 hours**
Meaning, brief history of cooperative development in India, objectives, principles of cooperation and significance of cooperatives in Indian agriculture.		
Module:6	**Agricultural Cooperation in India**	**5 hours**
Agricultural Cooperation in India-credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing and farming cooperatives and cooperative warehousing.		
Module: 7	**National level cooperatives**	**4 hours**
Role of Indian Commerce Association, National Cooperative Union of India, National Cooperative Development Corporation and National Agricultural Cooperative Marketing Federation of India.		
Module: 8	**Contemporary Issues**	**2 hours**
Lecture by Research/ Industrial Expert		
	Total Lecture hours:	**32**

Text Book	
1.	Subba Reddy, S and P. Raghu Ram. Agricultural Finance and Management. 2022. CBS Publishers & Distributors, Pvt. Ltd., India.
Reference Books	
1.	Subba Reddy S, P. Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi. 2019. Agricultural Economics, 2nd Revised edition. Oxford & IBH Co. Pvt. Ltd., India.
2.	Supriya, Gaurav Sharma, Aditya Bhooshan Srivatsava, Shikha Yadav and Rajini Gautam. 2024. New India Publishing Agency, India.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1	Determination of Most Profitable Level of Capital Use.	**2.5 hours**
2	Optimum Allocation of Limited Amount of Capital among Different Enterprise.	**2.5 hours**
3	Analysis of Progress and Performance of cooperatives using Published Data.	**2.5 hours**
4	Analysis of Progress and Performance of Commercial Banks and RRBs using Published Data.	**2.5 hours**
5	Visit to a Commercial Bank, Cooperative Bank/ Cooperative Society to acquire first-hand knowledge of their management, Schemes and Procedures.	**2.5 hours**
6	Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan-Fixation of Scale and Finance.	**2.5 hours**
7	Guest lecture on Role and Functions of Commercial Bank and Lead Bank/NABARD and its role and Functions.	**2.5 hours**
8	Estimation of credit requirement of Farm Business - A case study.	**2.5 hours**
9	Preparation and Analysis of Balance Sheet and Cash Flow Statement- A Case Study.	**2.5 hours**
10	Preparation and Analysis of Income Statement- A Case Study.	**2.5 hours**
11	Exercise on Financial Ratio Analysis. Appraisal of Farm Credit Proposals- A Case Study.	**2.5 hours**

12	Undiscounted Methods and Discounted Methods.	**2.5 hours**
13	Loan Repayment Plans.	**2.5 hours**
14	Preparation of Bankable Projects/ Farm Credit Proposals and Appraisal.	**2.5 hours**
15	Techno- Economic Parameters for Preparation of Projects for Various Agricultural Products and its Value added Products – Seminar on Various Topics.	**2.5 hours**
16	Analysis of Different Crop Insurance Products /Visit to crop insurance implementing agency.	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Subba Reddy, S and P. Raghu Ram. Agricultural Finance and Management. 2022. CBS Publishers & Distributors, Pvt. Ltd., India.	
Reference Books		
1.	Subba Reddy S, P. Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi. 2019. Agricultural Economics, 2nd Revised edition. Oxford & IBH Co. Pvt. Ltd., India.	
2.	Supriya, Gaurav Sharma, Aditya Bhooshan Srivatsava, Shikha Yadav and Rajini Gautam. 2024. New India Publishing Agency, India.	
Mode of Evaluation: Internal Assessment and Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date**	14-03-2024

Course code	**Agricultural Marketing Trade and Prices**	**L**	**T**	**P**	**C**
AECAG203		**2**	**0**	**2**	**3**
Pre-requisite					
AECAG202	Agricultural Finance and Co-operation				
	Syllabus version	1.0			

Course Objectives: The course is aimed at

1. Outlining information on marketing strategies of agricultural commodities.
2. Illustrating price dynamics and the role of government in regulation of markets.
3. Describing International trade policies

Expected Course Outcome: At the end of the course the student should be able to

1. Explain the importance of agricultural marketing
2. Comprehend marketing strategies of agricultural products
3. Understand efficient marketing and the role of government and public sectors in marketing
4. Interpret agricultural commodity prices and policies
5. Discuss trade at national and international level
6. Device plans for agricultural product marketing

Module:1	**Agricultural Marketing – Nature and Scope**	**4 hours**

Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation. Classification and characteristics of agricultural markets. Demand, supply and producer's surplus of agri-commodities. Nature and determinants of demand and supply of farm products. Producer's surplus– meaning and its types, marketable and marketed surplus, factors affecting marketable

surplus of agri-commodities.		
Module:2	**Product and its marketing strategies**	**4 hours**
Meaning, stages in product life cycle, its characteristics, and strategies in different stages. Pricing and promotion strategies: pricing considerations and approaches, cost based and competition-based pricing. Market promotion: advertising, personal selling, sales promotion and publicity, their meaning, merits, and demerits.		
Module:3	**Marketing process and functions**	**4 hours**
Marketing process and functions. Marketing process: concentration, dispersion, and equalization. Exchange functions: buying and selling; physical functions: storage, transport, and processing; facilitating functions: packaging, branding, grading, quality control and labelling (Agmark).		
Module:4	**Marketing Functionaries and Channels**	**5 hours**
Types and importance of agencies involved in agricultural marketing; meaning, definition of marketing channel; number of channel levels; marketing channels for different farm products. Integration, efficiency, costs and price spread: meaning, definition, types of market integration; marketing efficiency, costs, margins, price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs.		
Module:5	**Institutions in marketing**	**4 hours**
Role of Govt. in agricultural marketing. Public sector institutes-CWC, SWC, FCI, CACP and DMI–their objectives, functions. Cooperative marketing in India. Risk in marketing and its types.		
Module:6	**Agricultural prices and policy**	**4 hours**
Speculation and hedging; an overview of futures trading; agricultural prices and policy; meaning and functions of price; administered prices; need for agricultural price policy.		
Module: 7	**International Trade**	**5 hours**
Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO. Agreement on Agriculture (AoA) and its implications on Indian agriculture. IPR.		
Module: 8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**
Text Book		
1.	S. Acharya and N.L. Agarwal, Agricultural Marketing in India, 7th edition, 2020. Oxford and IBH, India.	
Reference Books		
1.	Subba Reddy, S and P. Raghu Ram. Agricultural Finance and Management. 2017. Oxford & IBH Publishing Company Private Ltd., India.	
2.	Kym Anderson. Agricultural Trade, Policy Reforms, and Global Food Security. 2016. Palgrave Macmillan Publishing Company, USA.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
List of Experiments		
1	Preparation of farm survey schedule	**2.5 hours**
2	Visit to Farm to collect information on marketing practices of agricultural commodities and marketing problems	**2.5 hours**

3	Plotting and study of demand and supply curves and calculation of elasticities	**2.5 hours**
4	Computation of marketable and marketed surplus of important commodities	**2.5 hours**
5	Visit to a local market / farmers' market to study various marketing functions performed by different agencies	**2.5 hours**
6	Study of relationship between market arrivals and prices of some selected commodities.	**2.5 hours**
7	Identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins; price spread estimation for major agricultural and allied agricultural products to assess their marketing efficiency; and presentation of report in the class	**2.5 hours**
8	Visit to market committee and regulated market to study their organization and functioning.	**2.5 hours**
9	Visit to co-operative marketing society to study its organization and functioning	**2.5 hours**
10	Visit to market institutions – SWC / CWC to study their organization and functioning	**2.5 hours**
11	Visit to AGMARK Laboratory / Grading institutions.	**2.5 hours**
12	Farm input marketing: Visit to Farm input dealer to study marketing of farm inputs	**2.5 hours**
13	Visit to Commodity Boards / AEZ / Export oriented units	**2.5 hours**
14	Time Series Analysis of prices–TCSI Study of price behaviour over time for some selected commodities	**2.5 hours**
15	Construction of Index Numbers and their uses.	**2.5 hours**
16	Application of principles of comparative advantage of international trade	**2.5 hours**
	Total Laboratory Hours	**40**

Text Books	
1.	S. Acharya and N.L. Agarwal, Agricultural Marketing in India, 7th edition, 2020. Oxford and IBH, India.
Reference Books	
1.	Subba Reddy, S and P. Raghu Ram. Agricultural Finance and Management. 2017. Oxford & IBH Publishing Company Private Ltd., India.
2.	Kym Anderson. Agricultural Trade, Policy Reforms, and Global Food Security. 2016. Palgrave Macmillan Publishing Company, USA.

Mode of Evaluation: Internal Assessment and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Farm Management Production and Resource Economics**	**L**	**T**	**P**	**C**
AECAG305		**1**	**0**	**2**	**2**
Pre-requisite					
AECAG202	Agricultural Finance and Co-operation				
	Syllabus version	1.0			
Course Objectives: The course is aimed at					

1. Discussing the principles of farm management and production economics
2. Explaining farm business management
3. Imparting knowledge on risks in agricultural production and management of resources

Expected Course Outcome: At the end of the course the student should be able to

1. Explain the importance of farm management in agriculture
2. Comprehend the benefits and cost involved in farm management
3. Analyze farm business
4. Devise plans to overcome risks and manage farm resources
5. Manage a farm
6. Manage a business

Module:1	**Concept and nature of farm management**	**2 hours**
Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms.		
Module:2	**Principles of farm management**	**3 hours**
Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage		
Module:3	**Cost and Income**	**2 hours**
Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income .		
Module:4	**Business management**	**2 hours**
Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts		
Module:5	**Farm planning and budgeting**	**2 hours**
Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.		
Module:6	**Risk and Insurance**	**2 hours**
Concept of risk and uncertainty occurrence in agriculture production, nature and sources of risks and its management strategies**.** Crop, livestock, machinery insurance, weather based crop insurance-features and determinants of compensation.		
Module: 7	**Resource economics**	**2 hours**
Concepts of resource economics, differences between NRE and agricultural economics. Unique properties of natural resources. Positive and negative externalities in agriculture, inefficiency and welfare loss and solutions. Important issues in economics and management of common property resources of land, water, pasture and forest resources		
Module: 8	**Contemporary Issues**	**1 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text Books		
1.	Ronald D. Kay, William M. Edwards, and Patricia A Duffy. Farm Management. 8th edition. 2015. McGraw–Hill Education, USA.	
2.	Raju, V.T and D.V.S. Rao. Economics of Farm Production and Management. 2017. Oxford and IBH Publishing Co. Pvt. Ltd., India.	
Reference Books		
1.	Subba Reddy S, P. Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi. Agricultural Economics, 2nd edition, 2019. Oxford & IBH Co. Pvt. Ltd., India.	
2.	Andrew Barkley and Paul W. Barkley. 2013. Principles of Agricultural Economics. Routledge, Taylor and Francis Group, USA.	
3.	Amarjit Singh, A.N. Sadhu and Jasbir Singh. Fundamentals of Agricultural Economics. 2016. Himalaya Publishing House, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
List of Experiments		
1	Preparation of Farm Layout and Estimation of Cost of Fencing of a farm	**2.5 hours**
2	Computation of depreciation and cost of farm assets: Valuation of assets by different methods.	**2.5 hours**
3	Application of equi-marginal returns /opportunity cost principle in allocation of farm resources	**2.5 hours**
4	Determination of most profitable level of inputs use in a farm production process	**2.5 hours**
5	Determination of least-cost combination (LCC) of inputs	**2.5 hours**
6	Selection of most profitable enterprise combination.	**2.5 hours**
7	Application of cost principles including CACP concepts in the estimation of cost of cultivation and cost of production of agricultural crops	**2.5 hours**
8	Estimation of cost of cultivation and cost of production of perennial crops / horticultural crops.	**2.5 hours**
9	Estimation of cost and returns of livestock products	**2.5 hours**
10	Preparation of farm plan and budget	**2.5 hours**
11	Farm records and accounts: Usefulness, types of farm records– farm production records-farm financial records.	**2.5 hours**
12	Preparation of Cash flow statement	**2.5 hours**
13	Preparation and Analysis of Net worth Statement and Profit and Loss statement.	**2.5 hours**
14	Estimation of Break – even analysis	**2.5 hours**
15	Graphical solution to Linear Programming problem.	**2.5 hours**
16	Collection and analysis of data on various resources in India.	**2.5 hours**
	Total Laboratory Hours	**40**
Text Books		
1.	Raju, V.T and D.V.S. Rao. Economics of Farm Production and Management. 2017. Oxford and IBH Publishing Co. Pvt. Ltd., India.	
Reference Books		
1.	Subba Reddy S, P. Raghu Ram, T.V. Neelakanta Sastry and I. Bhavani Devi. Agricultural Economics, 2nd edition, 2019. Oxford & IBH Co. Pvt. Ltd., India.	
2.	Andrew Barkley and Paul W. Barkley. 2013. Principles of Agricultural Economics. Routledge, Taylor and Francis Group, USA.	

Mode of Evaluation: Internal Assessment and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Agricultural Engineering							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
AEGAG101	Soil and Water Conservation Engineering	Embedded T & L	1	0	2	2	SACAG101
AEGAG202	Farm Machinery and Power	Embedded T & L	1	0	2	2	None
AEGAG203	Renewable Energy and Green Technology	Embedded T & L	1	0	2	2	None
AEGAG304	Protected Cultivation and Secondary Agriculture	Embedded T & L	1	0	2	2	None

Course code	**Soil and Water Conservation Engineering**	**L**	**T**	**P**	**C**
AEGAG101		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
SACAG101		1.0			

Course Objectives: The course is aimed at

1.Providing knowledge on different surveying methods used in agricultural field
2.Imparting knowledge on the loss of soil and techniques to conserve soil
3.Describing techniques of water harvesting and watershed concepts

Expected Course Outcome: At the end of the course the student should be able to

1.Apply different surveying methods to measure area in agricultural field
2.Determine soil loss for a specific area based on erosivity and erodibility factor
3.Relate different techniques to control wind erosion
4.Apply rain water harvesting methods to conserve water
5.Interpret case studies related to soil and water conservation
6.Design irrigation systems and plan erosion control measures

Module:1	**Surveying**	**2 hours**

Introduction to Surveying- Chain and Plane table surveying, applications, area computation by trapezoidal and Simpson's rule.

Module:2	**Soil and Water Erosion**	**2 hours**

Soil erosion: causes, agents, effects of soil erosion, geologic and accelerated erosion. Water erosion: causes, forms, erosivity and erodibility. Mechanics of water erosion: splash, sheet, rill and gully. Gully classification and control measures. Soil loss estimation - Universal soil loss equation; Soil loss measurement techniques.

Module:3	**Erosion control and conservation techniques**	**2 hours**

Biological measures: contour cultivation, strip cropping and cropping systems. Vegetative measures: Vetiver and other natural grass barriers.

Module:4	**Mechanical measures of erosion control**	**2 hours**

Mechanical measures: contour bund, graded bund, broad beds and furrows, basin

listing, random tie ridging. Mechanical measures for hill slopes: contour trench, bench terrace, contour stone wall and gully control structures.		
Module:5	**Wind erosion**	**2 hours**
Factors influencing wind erosion. Mechanics of wind erosion: suspension, saltation and surface creep. Control measures: windbreaks and shelterbelts. Sand dunes and their stabilization.		
Module:6	**Rain water harvesting**	**2 hours**
In-situ soil moisture conservation: micro catchments and eroded catchments. Roof water harvesting: storage and its use for domestic and groundwater recharge. Farm ponds and percolation ponds.		
Module:7	**Watershed**	**2 hours**
Watershed concept, objectives, code, and watershed management.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by expert		
	Total Lecture hours:	**16**
Text Book		
1	Suresh R. Soil and Water Conservation Engineering, 2020. Standard Publishers and Distributors Pvt. Ltd., India.	
Reference Books		
1	Ashwani Kumar and Sheshnath Rawath. Basic Principles of Soil and Water Conservation Engineering Practices, 2023. Jain Brothers, India.	
2	S.K. Gupta. Fundamentals of Soil and Water Conservation Engineering. 2020. Daya Publishing House, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1	Study of chain surveying instruments	**2.5 hours**
2	Computation of area by chain surveying	**2.5 hours**
3	Computation of area and volume for earth work excavation using Simpson's formula	**2.5 hours**
4	Computation of area and volume for earth work excavation using trapezoidal formula	**2.5 hours**
5	Study of plane table surveying instruments	**2.5 hours**
6	Plane table surveying using radiation method	**2.5 hours**
7	Plane table surveying using intersection method	**2.5 hours**
8	Introduction to levelling instruments	**2.5 hours**
9	Levelling using rise and fall method and height of collimation method	**2.5 hours**
10	Status of soil conservation in India	**2.5 hours**
11	Estimation of erosion index and erosivity from rainfall Data	**2.5 hours**
12	Estimation and measurement of soil loss using USLE Method	**2.5 hours**
13	Design of contour and graded bund	**2.5 hours**
14	Design of grassed waterways and bench terracing system	**2.5 hours**
15	Contour maps: Area and volume computations	**2.5 hours**
16	Problems on wind erosion	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	B.C. Mal. Introduction to Soil and Water Conservation Engineering. 2019. Kalyani Publishers, India.	

Reference Books				
1.	Gupta, Rajesh. Elementary Soil and Water Conservation Engineering, 2020. Biotech Books, India.			
2.	Ashwani Kumar and Sheshnath Rawath. Basic Principles of Soil and Water Conservation Engineering Practices, 2023. Jain Brothers, India.			
Mode of Evaluation: Internal assessments and Final assessment test				
Recommended by Board of Studies		28-02-2024		
Approved by Academic Council		No.73	**Date**	14-03-2024

Course code	**Farm Machinery and Power**	**L**	**T**	**P**	**C**
AEGAG202		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed to

1. Explain the farm and tractor power used in agriculture
2. Demonstrate different farm implements and its uses in agriculture
3. Discuss the selection of farm implements and its cost benefit analysis

Expected Course Outcome: At the end of the course the student should be able to

1. Identify and differentiate two stroke and four stroke I.C engines
2. Distinguish different components and systems of IC engines
3. Compare different tillage implements used for various agricultural purposes
4. Classify various farm implements and comprehend its calibration methods
5. Estimate the cost benefit economics of various farm implements
6. Experiment with different equipment used in agricultural fields from planting to harvesting

Module:1	**Farm and tractor power**	**2 hours**
Status of farm power in India, sources of farm power, I.C. engines, working principles of I.C. engines, comparison of two stroke and four stroke cycle engines.		
Module:2	**I.C. Engine components**	**2 hours**
Study of different components of I.C. engine, I.C. engine terminology and solved problems; Different systems of I.C.		
Module:3	**Systems of IC engines**	**5 hours**
Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor. Power transmission system: clutch, gear box, differential and final drive of a tractor. Tractor types. Cost analysis of tractor power and attached implement.		
Module:4	**Primary Tillage implements**	**1 hour**
Familiarization with primary tillage implement, types and its applications		
Module:5	**Secondary tillage implements**	**1 hour**
Familiarization with secondary tillage implements, types and its application, implement for hill agriculture and implement for intercultural operations.		
Module:6	**Sowing, and planting equipment**	**1 hour**
Familiarization with sowing and planting equipment. Calibration of a seed drill and solved examples.		
Module:7	**Plant protection and harvesting equipment**	**2 hours**
Familiarization with plant protection equipment. Familiarization with harvesting and threshing equipment.		
Module:8	**Contemporary Issues**	**2 hours**

Lecture by expert		
	Total Lecture hours:	**16**
Text Book		
1	Sunil Mekala. Farm Machinery and Power. 2017. Random Publications,India.	
Reference Books		
1	Kalay Khan, Jagvir Dixit, Padam Singh and Mukesh Rana. Elements of Farm Power and Machinery. 2020. Brillion Publishing, India.	
2	T. Senthilkumar, B. Suthakar, G. Manikandan (2023). A Textbook of Farm Machinery and Equipment: Principles and Practice Paperback. Brillion Publishing	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Study of I.C. engine and their components	**2.5 hours**
2.	Study of air cleaning system of engine	**2.5 hours**
3.	Study of cooling system of engine	**2.5 hours**
4.	Study of lubrication system of engine	**2.5 hours**
5.	Study of Fuel system of engine	**2.5 hours**
6.	Familiarization with power transmission system of a tractor	**2.5 hours**
7.	Familiarization with brake and steering system of engine	**2.5 hours**
8.	Familiarization with hydraulic control system of engine	**2.5 hours**
9.	Learning driving of tractor and power tiller	**2.5 hours**
10.	Familiarization with operation of power tiller, Implements for hill agriculture	**2.5 hours**
11.	Study of different types of primary tillage implements	**2.5 hours**
12.	Study of different types of secondary tillage implements	**2.5 hours**
13.	Familiarization with seed cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter	**2.5 hours**
14.	Study of different types of sprayers and dusters	**2.5 hours**
15.	Familiarization with different intercultivation equipment	**2.5 hours**
16.	Study of harvesting and threshing machinery	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	Basavaraj, D Srigiri, Jayan, P.R. A Textbook of Farm Machinery & Power Engineering, 2019. New India Publishing Agency-Nipa, India.	
Reference Books		
1.	Ajay Verma and Manisha Sahu. Farm Machinery And Power Engineering. 2019. Jain Brothers, India	
2.	T. Senthilkumar, B. Suthakar, G. Manikandan A Textbook of Farm Machinery and Equipment: Principles and Practice, 2023. Brillion Publishing, India.	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date**	14-03-2024

Course code	**Renewable Energy and Green Technology**	**L**	**T**	**P**	**C**
AEGAG203		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			
Course Objectives: The course is aimed to					

1. Discuss the importance of renewable energy and its sources
2. Demonstrate about different types of biogas plants and its uses
3. Explain the basics of solar energy, wind energy and their applications

Expected Course Outcome: At the end of the course the student should be able to

1. Summarize the importance of renewable energy and its sources
2. Compare different biogas plants, its benefits, advantages and cost analysis
3. Discuss the importance of solar energy and its applications
4. Explain the need of wind energy and energy components involved and their applications
5. Interpret merits and demerits of various renewable sources of energy
6. Design simple projects based on renewable energy systems

Module:1	**Introduction to renewable energy and its sources**	**1 hour**
Classification of energy sources and contribution of these of sources in agricultural sector		
Module:2	**Biomass energy**	**3 hours**
Familiarization with biomass utilization for biofuel production and their application, bio-alcohol, biodiesel and bio-oil production and their utilization as bioenergy resource.		
Module:3	**Biogas plants**	**3 hours**
Familiarization with types of biogas plants, working principle, factors affecting biogas production and design calculation.		
Module:4	**Solar energy**	**2 hours**
Introduction of solar energy, collection and their application. Familiarization with solar energy gadgets: solar cooker and solar water heater.		
Module:5	**Solar energy applications**	**1 hour**
Application of solar energy: solar drying, solar pond and solar distillation.		
Module:6	**Solar Photovoltaic system**	**2 hours**
Solar photovoltaic system, working principle, types and their application.		
Module:7	**Wind energy and its applications**	**2 hours**
Introduction to wind energy and its applications. Wind turbines and wind farms.		
Module:8	**Contemporary Issues**	**2 hour**
Lecture by expert		
	Total Lecture hours:	**16 hrs**

Text Book

1	Singhal, B.L. Renewable Energy Sources and Management. 2016. Tech-Max Publication, India.

Reference Books

1	V.V. N. Kishore. Renewable Energy Engineering and Technology: Principles and Practice. 2019. Routledge, UK.
2	R Dogra, M. Singh, Y.M. Singla, D. Kumar and R. Gupta. Renewable Energy and Green Technology. 2023. Brillion Publishing, India.

Mode of assessment: Assignment, Mid-semester and Final assessment test

Indicative Experiments		
1	Familiarization with renewable energy gadgets	2.5 hours
2	Study on gasifiers	2.5 hours
3	Study of biogas plants -Floating Drum Type	2.5 hours
4	Study of biogas plants -Fixed Dome Type	2.5 hours

5	Biogas production process	2.5 hours
6	Designing a biogas plant for a household	2.5 hours
7	Study of production process of biodiesel	2.5 hours
8	Study of briquetting machine, briquettes, and its sources	2.5 hours
9	Production process of bio-fuels.	2.5 hours
10	Familiarization with different solar energy gadgets.	2.5 hours
11	Study of solar photovoltaic system: solar light, solar pumping and solar fencing.	2.5 hours
12	Study of solar cooker and its components	2.5 hours
13	Study solar drying system	2.5 hours
14	Solar distillation and solar pond	2.5 hours
15	Designing a roof top solar for a household	2.5 hours
16	Visit to the local biogas plant	2.5 hours
	Total Laboratory Hours	**40**

Text Book

1.	David M. Buchla, Thomas E. Kissell, Thomas L. Floyd. 2017. Renewable Energy Systems. Pearson Education, UK.

Reference Books

1.	Nilamoni Saikia. Renewable Energy and Energy Harvesting. 2022. Mahaveer Publications, India.
2.	R Dogra, M. Singh, Y.M. Singla, D. Kumar and R. Gupta. Renewable Energy and Green Technology. 2023. Brillion Publishing, India.

Mode of Evaluation: Internal assessments and Final assessment test

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Protected Cultivation and Secondary Agriculture**	**L**	**T**	**P**	**C**
AEGAG304		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed to

1. Explain the basics of protected cultivation and its significance in crop cultivation
2. Demonstrate about different types of greenhouse, its design and cost estimation.
3. Discuss about various drying methods and dryers for post-harvest processing of crops

Expected Course Outcome: At the end of the course the student should be able to

1. Summarize the scope of greenhouse technology in improving crop production
2. Compare various types of greenhouses, its advantages and cost benefits
3. Elaborate on post-harvest processing techniques of various crops
4. Compare different drying methods and dryer types applicable for various crops
5. Explain uses of greenhouse pertaining to crop production and post-harvest processing

Module:1	**Greenhouse technology**	**1 hours**

Introduction, History of green house, Advantages of green house, Greenhouse effect.

Types of Greenhouses: Greenhouse type based on Shape, Utility, Construction and Covering materials		
Module:2	**Plant response to greenhouse environment**	**2 hours**
Plant response to greenhouse environment: Light, Temperature, Relative Humidity, Ventilation and Carbon di-oxide.		
Module:3	**Planning and Design of green house**	**3 hours**
Planning and Design of greenhouse: Site selection and orientation, structural design and covering materials. Design criteria of green house for Cooling and Heating purposes: Cooling - Natural ventilation, forced ventilation; Heating - Heating system, solar heating system		
Module:4	**Greenhouse equipment cost analysis**	**2 hours**
Greenhouse equipment, materials of construction for traditional and low-cost greenhouses: Wood, G.I., aluminum, steel, R.C.C. and Glass. Passive solar green house, hot air greenhouse heating systems. Cost estimation and economic analysis.		
Module:5	**Irrigation Systems in green house and Greenhouse drying**	**2 hours**
Rules of watering, Overhead Sprinklers, Drip irrigation system and Foggers (Mist spraying). Sun drying, Mechanical Drying Methods: - Contact drying, Convection drying, Radiation drying		
Module:6	**Post-harvest technology**	**2 hours**
Important engineering properties such as physical, thermal, aero and hydrodynamic properties of cereals, pulses and oilseeds, their application in PHT equipment design and operation.		
Module:7	**Drying methods and dryer types**	**2 hours**
Drying and dehydration, moisture measurement, EMC, drying theory, various drying methods, commercial grain dryer: deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer. Material handling equipment, conveyer and elevators, their principle, working and selection.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture Hours:	**16 Hours**
Text Book		
1.	Sanjeev Kumar; S.N. Saravaiya and A.K. PandeyPrecision Farming and Protected Cultivation Concepts and Applications. 2021. CRC press, USA.	
2.	Amalendu Chakraverty and R. Paul Singh. Post-harvest technology and food process engineering. 2016. CRC press, USA.	
Reference Books		
1.	D. K. Singh and K.V. Peter. Protected Cultivation of Horticultural crops. 2016. New India Publishing Agency, India.	
2.	Nicolas Castilla. Greenhouse Technology and Management. 2018. 2nd Edition. CABI, UK.	
3.	K.P. Sudheer and V. Indira. Post-harvest technology of horticultural crops. Volume 7, 2020. New India publishing agency, India.	
Indicative Experiments		
1.	Study of different type of greenhouses based on shape.	**2.5 hours**
2.	Design criteria of green house.	**2.5 hours**
3.	Determine the rate of air exchange in an active summer winter cooling system.	**2.5 hours**
4.	Components of green house	**2.5 hours**

5.	Study of greenhouse equipment.	**2.5 hours**
6.	Irrigation in green house	**2.5 hours**
7.	Determination of drying rate of agricultural products inside green house	**2.5 hours**
8.	Determination of physicochemical properties of agricultural produce	**2.5 hours**
9.	Determination of engineering properties of agricultural produce	**2.5 hours**
10.	Determination of Moisture content of various grains	**2.5 hours**
11.	Determination of moisture content of various grains by oven drying method.	**2.5 hours**
12.	Determination of moisture content of various grains by infrared method and moisture meter	**2.5 hours**
13.	Field visit to a seed processing plant.	**2.5 hours**
14.	Visit to various Post Harvest Laboratories.	**2.5 hours**
15.	Prototype development	**2.5 hours**
16.	Product development	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Ratnesh Kumar, Suresh Chandra and Samsher. Practical Manual on Protected Cultivation and Secondary Agriculture. 2020. Jain Brothers, India.	
2.	Sanjeev Kumar, S.N. Saravaiya, and A.K. Pandey. Precision Farming and Protected Cultivation: Concepts and Applications. 2021. CRC Press, India	
Reference Books		
1.	Brahma Singh. Precision Farming and Protected Cultivation. 2020. New India publishing agency, India.	
2.	Amit Ashokrao Deogirikar, and Vaishali Rameshrao Wankhade. Protected Cultivation and Secondary Agriculture. 2021. Brillion Publishing, India.	

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14.03.2024

Plant Pathology							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
PATAG101	Fundamentals of Plant Pathology	Embedded T & L	3	0	2	4	None
PATAG302	Principles of Integrated Pest and Disease Management	Embedded T & L	2	0	2	3	AENAG101 & PATAG101
PATAG303	Diseases of Field and Horticultural Crops and their Management - I	Embedded T & L	2	0	2	3	PATAG101
PATAG304	Diseases of Field and Horticultural Crops and their Management - II	Embedded T & L	2	0	2	3	PATAG101

Course code	Fundamentals of Plant Pathology	L	T	P	C
PATAG101		3	0	2	4
Pre-requisite	None	Syllabus version			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on importance of plant diseases, pathogens and development of plant diseases, disease cycle, physiology of pathogens and plant defense
2. Describing epidemiology of plant diseases and strategies for management
3. Explaining morphology, vegetative, reproductive structures and resting structures of fungi, bacteria, nematodes and other plant pathogens

Expected Course Outcome: At the end of the course the student should be able to

1. Recognize the importance and scope of plant pathology and analyse the causes and factors leading to pathogenesis
2. Classify pathogens taxonomically for designing effective disease management strategies
3. Differentiate plant pathogens based on morphology, vegetative, reproductive and resting structures.
4. Relate disease cycles, physiology of pathogens and plant defense
5. Describe epidemiology of plant diseases and strategies for disease management
6. Practice identifying and controlling pathogens

Module:1	Importance of plant diseases	4 hours

Importance, scope and objectives of plant pathology. History of plant pathology with special reference to Indian work. Terms and concepts in Plant Pathology.

Module:2	Plant pathogenesis	6 hours

Causes and factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases.

Module:3	Plant pathogenic organisms	6 hours

Important groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them.

Module:4	Fungal pathogens, diseases and symptoms	8 hours

General characters and definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub- divisions, orders and classes.

Module:5	Bacteria, viruses and nematodes	8 hours

General morphological characters, basic methods of methods of classification and reproduction. Nature, structure, replication and transmission of viruses. Study of phanerogamic plant parasites. General morphology, reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera, Meloidogyne*, *Anguinaand Radopholus*).

Module:6	Disease cycle, physiology and plant defense	8 hours

Growth and reproduction of plant pathogens. Liberation or dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes,toxins and growth regulators in disease development. Defense mechanism in plants**.**

Module:7	**Epidemiology and principles of disease management**	**6 hours**
Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**48**
Text Books		
1.	Singh, R.S. Introduction to Principles of Plant Pathology. 5th Edition, 2017. MedTech Publishers, India.	
2.	Mehrotra, R.S. and A. Aggarwal. Plant Pathology. 3rd Edition, 2017. Tata McGraw Hill Publishing Co Ltd., India.	
3.	Alice, D. and C. Jeyalakshmi. Plant Pathology.2nd edition, 2014. A.E. Publications, Coimbatore, India.	
4.	Agrios, G.N. Plant Pathology, 5th Edition, 2005. Academic Press, New York.	
Reference Books		
1.	Narayanasamy, P. Microbial Plant Pathogens: Detection and Management in Seedsand Propagules. 2017. Wiley-Blackwell. New Jersey, USA.	
2.	Singh, R.S. Plant Diseases. 10th Edition, 2017. MedTech Publishers, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Acquaintance with various laboratory equipment and microscopy	**2.5 hours**
2.	Handling of microscopes	**2.5 hours**
3.	Preparation of mounts and examination of fungal spores	**2.5 hours**
4.	Preparation of media for isolation of plant pathogens and proving Koch's postulates	**2.5 hours**
5.	Artificial infection and re-isolation of pathogens	**2.5 hours**
6.	General characters of fungi-types of mycelia-types of vegetative, asexual and sexual spores- asexual and sexual fruiting bodies	**2.5 hours**
7.	Field visit and collection of disease plant specimens - Agriculture crops	**2.5 hours**
8.	Field visit and collection of disease plant specimens - Horticulture crops	**2.5 hours**
9.	Transmission of plant viruses	**2.5 hours**
10.	Study of phanerogamic plant parasites	**2.5 hours**
11.	Morphological features and identification of plant parasitic nematodes	**2.5hours**
12.	Sampling, extraction and nematode mounting from soil and plants	**2.5 hours**
13.	Study of fungicide formulations to control plant diseases	**2.5 hours**
14.	Study of biological control	**2.5 hours**
15.	Methods of fungicide and biocontrol applications,	**2.5 hours**
16.	Safety and calculation of spray concentrations	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Books		

1.	Singh, R.S. Introduction to Principles of Plant Pathology. 5th Edition, 2017. MedTech Publishers, India.
2.	Mehrotra, R.S. and A. Aggarwal. Plant Pathology. 3rd Edition, 2017. Tata McGraw Hill Publishing Co Ltd., India.
3.	Alice, D. and C. Jeyalakshmi. Plant Pathology.2nd edition, 2014. A.E. Publications, Coimbatore, India.
4.	Agrios, G.N. Plant Pathology, 5th Edition, 2005. Academic Press, New York.
Reference Books	
1.	Darshan, K. M., Amrutha Laksmi and M. Guruvireddy. Phytopathological Techniques (1), 2021. Self-publishing, New Delhi, India
2.	Aneja, K.R. An Introduction to Mycology. 2nd Edition, 2015. New Age International Pvt., Ltd., Chennai, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Principles of Integrated Pest and Disease Management**	**L**	**T**	**P**	**C**
PATAG302		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
PATAG101 & AENAG101	Fundamentals of Plant Pathology and Fundamentals of Entomology	1.0			

Course Objectives: The course is aimed at

1. Describing the economic importance of pest and diseases and its effect on plants
2. Demonstrate the use of appropriate control and eradication methods
3. Recognizing effective and environmentally friendly methods to control pests and diseases

Expected Course Outcome: At the end of the course the student should be able to

1. Collect data on pest and disease attacks in a farmer's field
2. Calculate the threshold level of crop pests and diseases
3. Device crop pest and disease control measures
4. Recommend integrated pest and disease control measures
5. Diagnose and assess integrated pest and disease management
6. Practice integrated pest and disease management

Module:1	**Pest and disease categories**	**3 hours**
Identification of insect pest and disease categories in agricultural and horticultural crops.		
Module:2	**Scope and importance**	**5 hours**
Introduction to integrated pest and disease management, history, importance, concepts, principles and tools		
Module:3	**Risk analysis**	**4 hours**
Economic importance of insect pests, diseases and risk analysis. Methods of detection and diagnosis of insect pest and diseases.		
Module:4	**Concepts of EIL and ETL**	**4 hours**
Calculation and dynamics of economic injury level and importance of economic threshold level of pest and diseases		
Module:5	**Control measures**	**6 hours**

Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control of insects and diseases. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management.		
Module:6	**Pest and disease forecasting**	**4 hours**
Survey surveillance and forecasting of insect pests and diseases. Development and validation of integrated pest and pathogen management modules.		
Module:7	**Implementation and impact**	**4 hours**
Implementation and impact of IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programs.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**

Text Books	
1.	Handbook of Integrated Pest Management. 2018. ICAR, Govt. of India.
2.	Mehrotra, R.S. and A. Aggarwal. Plant Pathology. 3rd Edition, 2017. Tata McGraw Hill Publishing Co Ltd., India.
Reference Books	
1.	Dharam P. Abrol and Uma Shankar. 2016. Integrated Pest Management: Principles and Practice. Reprint Edition. CABI Publishing, UK.
2.	Somnath Sen and Mohd. Sameer. A Textbook of Insect Pest and Disease Management. 2021. Bhavya Books, India.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Methods of diagnosis and detection of various insect pests in agricultural and horticultural crops	**2.5 hours**
2.	Methods of diagnosis and detection of various diseases in agricultural and horticultural crops	**2.5 hours**
3.	Identification of major insect pests of field crops and their damage symptoms	**2.5 hours**
4.	Identification of major insect pests of horticultural crops and their damage symptoms	**2.5 hours**
5.	Identification of major diseases of field crops and their damage symptoms	**2.5 hours**
6.	Identification of major diseases of horticultural crops and their damage symptoms	**2.5 hours**
7.	Assessment of crop yield losses and calculations based on economics of IPM	**2.5 hours**
8.	Components of Agro Eco System	**2.5 hours**
9.	Field scouting methodology	**2.5 hours**
10.	Crop monitoring techniques to control pest and diseases	**2.5 hours**
11.	Assessment of preventive strategies for crop pests and diseases through conventional and IPM modules	**2.5 hours**
12.	Identification of natural enemies of pests	**2.5 hours**
13.	Mass multiplication of major parasitoids and predators	**2.5 hours**
14.	Mass multiplication of microbial bio-control agents	**2.5 hours**
15.	Familiarization with pesticides and plant protection equipment	**2.5 hours**

16.	Awareness campaign at farmers' fields	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Handbook of Integrated Pest Management. 2018. ICAR, Govt. of India.	
2.	Mehrotra, R.S. and A. Aggarwal. Plant Pathology. 2017. 3rd Edition, Tata McGraw Hill Publishing Co Ltd., India.	
Reference Books		
1.	Dharam P. Abrol and Uma Shankar. 2016. Integrated Pest Management: Principles and Practice. Reprint Edition. CABI Publishing, UK.	
2.	Somnath Sen and Mohd. Sameer. A Textbook of Insect Pest and Disease Management. 2021. Bhavya Books, India.	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date**	14-03-2024

Course code	**Diseases of Field and Horticultural Crops and their Management - I**	**L**	**T**	**P**	**C**
PATAG303		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
PATAG101	Fundamentals of Plant Pathology	1.0			

Course Objectives: The course is aimed at

1.Imparting knowledge on major agricultural and horticultural diseases
2.Describing the disease causing organism and its mode of spread
3.Providing information on management of diseased crops

Expected Course Outcome: At the end of the course the student should be able to

1. Identify and manage major diseases of cereals and millets
2. Manage diseases of pulses and oilseeds
3. Understand the management practices of major diseases affecting vegetables
4. Recognise disease symptoms of fruit crops and plan control measures
5. Comprehend the disease management practices of plantation crops
6.Recommend management practices for major diseases of agricultural and horticultural crops

Module:1	**Diseases of cereals**	**4 hours**

Symptoms, etiology, disease cycle and management of major diseases of rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; maize: stalk rots, downy mildew and leaf spots.

Module :2	**Diseases of millets**	**3 hours**

Symptoms, etiology, disease cycle and management of major diseases of sorghum: smuts, grain mold and anthracnose; bajra: downy mildew and ergot and finger millet: blast and leaf spot

Module:3	**Diseases of pulses**	**3 hours**

Symptoms, etiology, disease cycle and management of major diseases of pigeonpea: Phytophthora blight, wilt and sterility mosaic; black and green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic.

Module:4	**Diseases of oilseeds**	**3 hours**

Symptoms, etiology, disease cycle and management of major diseases of soybean:

Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; groundnut: early, late leaf spots, wilt; and castor: Phytophthora blight		
Module:5	**Diseases of vegetables**	**7 hours**
Symptoms, etiology, disease cycle and management of major diseases of cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight, fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot, leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot and Colocasia: Phytophthora blight		
Module:6	**Diseases of fruit crops**	**5 hours**
Symptoms, etiology, disease cycle and management of major diseases of Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight;		
Module:7	**Diseases of plantation crops**	**5 hours**
Symptoms, etiology, disease cycle and management of major diseases of major diseases of Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust and Tobacco: black shank, black root rot and mosaic		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**

Text Book	
1.	S.C. Dubey, P. Aggarwal, R., Patro and T.S.S.K., Sharma. Diseases of field crops and their management. 2016. Today and tomorrow, India.
2.	Manoj Kumar Kalita. Diseases of field and horticultural crops and their management. 2018. Kalyani Publishers, India.
Reference Books	
1.	Mehrotra, R.S. and A. Aggarwal. Plant Pathology. 3rd Edition, 2017. Tata McGraw Hill Publishing Co Ltd., India.
2.	Singh, R.S. Plant Diseases, 10th edition, 2017. Medtech, India.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases rice	**2.5 hours**
2.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of maize and sorghum	**2.5 hours**
3.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of bajra and finger millet	**2.5 hours**
4.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of pigeonpea, urdbean and mungbean	**2.5 hours**
5.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of groundnut	**2.5 hours**
6.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of pigeonpea, urdbean and mungbean	**2.5 hours**
7.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of guava and	**2.5 hours**

	banana	
8.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of papaya and pomegranate	**2.5 hours**
9.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of tomato and brinjal	**2.5 hours**
10.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of cruciferous	**2.5 hours**
11.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of sweet potato and beans	**2.5 hours**
12.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of coconut, arecanut and coffee	**2.5 hours**
13.	Survey, collection and calculation of major field and horticulture crop disease incidence	**2.5 hours**
14.	Preservation of 50 well mounted plant diseased specimens from varied crops for Herbarium	**2.5 hours**
15.	Methods of application of fungicides	**2.5 hours**
16.	Calculation of spray concentrations	**2.5 hours**
	Total Laboratory Hours	**40**

Text Book	
1.	Manoj Kumar Kalita.2018. Diseases of field and horticultural crops and their management - I.First edition, Kalyani Pubications, India.
Reference Books	
1.	Darshan, K. M. Amrutha Laksmi and M. Guruvireddy. Phytopathological Techniques (1). 2021. Self-publishing, New Delhi, India.
2.	Narayanasamy, P. Microbial Plant Pathogens: Detection and Management in Seeds and Propagules. 2017. Wiley-Blackwell. New Jersey, USA.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Diseases of Field and Horticultural Crops and their Management - II**	**L**	**T**	**P**	**C**
PATAG304		**2**	**0**	**2**	**3**
Pre-requisite	Fundamentals of Plant Pathology	**Syllabus version**			
PATAG101		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on major agricultural and horticultural diseases
2. Describing the disease causing organism and its mode of spread
3. Providing information on management of diseased crops

Expected Course Outcome: At the end of the course the student should be able to

1. Identify and manage major diseases of cereals and pulses
2. Manage diseases of cash crops and oilseeds

3. Understand the management practices of major diseases affecting vegetables 4. Recognise disease symptoms of spices and flower crops and plan control measures 5. Comprehend the disease management practices of fruit crops 6.Recommend management practices for major diseases of agricultural and horticultural crops		
Module:1	**Diseases of cereals**	**4 hours**
Symptoms, etiology, disease cycle and management of major diseases of Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight and ear cockle		
Module:2	**Diseases of pulses**	**3 hours**
Symptoms, etiology, disease cycle and management of major diseases of Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Pea: downy mildew, powdery mildew and rust.		
Module:3	**Diseases of cash crops**	**3 hours**
Symptoms, etiology, disease cycle and management of major diseases of Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng; Cotton: anthracnose, vascular wilt, and black arm		
Module:4	**Diseases of oilseeds**	**3 hours**
Symptoms, etiology, disease cycle and management of major diseases of Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot.		
Module:5	**Vegetables**	**5 hours**
Symptoms, etiology, disease cycle and management of major diseases of Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight.		
Module:6	**Spices and flower crops**	**7 hours**
Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot; Coriander: stem gall; Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.		
Module:7	**Fruit crops**	**5 hours**
Symptoms, etiology, disease cycle and management of major diseases of Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl; Strawberry: leaf spot.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**
Text Books		
1.	Sanjeev Kumar. Diseases of Field & Horticultural Crops and Their Management-II. 2022. New India Publishing Agency, India.	
2.	Manoj Kumar Kalita. Diseases of field and horticultural crops and their management. 2018. Kalyani Publishers, India.	
Reference Books		
1.	Narayanasamy, P. Microbial Plant Pathogens: Detection and Management in Seeds and Propagules. . 2017. Wiley-Blackwell. New Jersey, USA.	
2.	Mehrotra, R.S. and A. Aggarwal. Plant Pathology. 3rd Edition, 2017. Tata McGraw Hill Publishing Co Ltd., India.	
3.	Singh, R.S. Plant Diseases, 10th edition, 2017. Medtech, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
List of Experiments		

1.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of wheat and gram	**2.5 hours**
2.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of lentil and pea	**2.5 hours**
3.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of sugarcane and cotton	**2.5 hours**
4.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of sunflower and mustard	**2.5 hours**
5.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of potato and cucurbits	**2.5 hours**
6.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of garlic and onion	**2.5 hours**
7.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of chillies and turmeric	**2.5 hours**
8.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of coriander, marigold and rose	**2.5 hours**
9.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of mango	**2.5 hours**
10.	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of citrus and grapevine	**2.5 hours**
11	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of apple	**2.5 hours**
12	Field level identification, diagnosis of symptoms and histopathological studies of major diseases of peach and strawberry	**2.5 hours**
13	Survey, collection and calculation of major field and horticulture crop disease incidence	**2.5 hours**
14	Preservation of 50 well mounted plant diseased specimens from varied crops for Herbarium	**2.5 hours**
15	Methods of application of fungicides	**2.5 hours**
16	Calculation of spray concentrations	**2.5 hours**
	Total Laboratory Hours	**40**

Text Book	
1.	Sanjeev Kumar. Diseases of Field and Horticultural Crops and Their Management-II. 2022. New India Publishing Agency, India.
Reference Books	
1.	Darshan, K. M. Amrutha Laksmi and M. Guruvireddy. Phytopathological Techniques (1). 2021. Self-publishing, India.
2.	Narayanasamy, P. Microbial Plant Pathogens: Detection and Management in Seeds and Propagules. 2017. Wiley-Blackwell. New Jersey, USA.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Horticulture							
Course	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**

Code							
HORAG101	Fundamentals of Horticulture	Embedded T & L	1	0	2	2	None
HORAG202	Production Technology for Vegetables and Spices	Embedded T & L	1	0	2	2	HORAG101
HORAG203	Production Technology for Ornamental Crops, MAP and Landscaping	Embedded T & L	1	0	2	2	HORAG101
HORAG204	Production Technology for Fruit and Plantation Crops	Embedded T & L	1	0	2	2	HORAG101
HORAG307	Post Harvest Management and Value Addition of Fruits and Vegetables	Embedded T & L	1	0	2	2	HORAG101

Course code	**Fundamentals of Horticulture**	**L**	**T**	**P**	**C**
HORAG101		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Demonstrating fundamental principles of plant growth and development
2. Demonstrating practical applications of horticulture
3. Defining current technologies used in horticultural enterprises

Expected Course Outcome: At the end of the course the student should be able to

1. Comprehend the fundamentals of horticulture in terms of its value
2. Propagate horticultural plants and trees
3. Design orchards and landscapes for architectural firms
4. Decide on the crops, fertilizers and irrigation measures to be followed by farmers
5. Develop career interest in the field of horticulture

Module:1	**Horticulture: Scope and Importance**	**2 hours**
Definition, divisions and branches of horticulture. Importance of horticulture in terms of income, employment generation, industry, religious, aesthetic, food, nutritive value and export.		
Module: 2	**Botanical classification and Influence of environmental factors on horticultural crops**	**2 hours**
Horticultural and botanical classification. Climate and soil for horticultural crops. Influence of environmental factors on crop production: Temperature, humidity, wind, rainfall and solar radiation. Influence of soil factors: Soil type, pH and EC.		
Module: 3	**Sexual Propagation**	**2 hours**
Sexual methods of propagation- seed dormancy and seed germination		
Module: 4	**Asexual Propagation**	**2hours**

Asexual methods of propagation: stem, leaf and root cuttings, layering, separation, bulbs, corms, division, grafting and budding.		
Module: 5	**Principles of orchard establishment**	**2 hours**
Layout of orchards. Systems of planting. Principles and methods of training and pruning - open center, closed center and modified leader systems. Juvenility and flower bud differentiation: methods for shortening juvenility and bearing habits of fruit trees. Unfruitfulness, pollination, pollinizers and pollinators, Lawn making, Fertilization and parthenocarpy, Medicinal and aromatic plants.		
Module: 6	**Plant bio-regulators**	**2 hours**
Importance and applications of plant bio-regulators.		
Module: 7	**Irrigation and fertilizer application**	**2 hours**
Irrigation methods - check basin, furrow, ring basin, basin, flood, pitcher, funnel, drip and sprinkler. Fertilizer application methods – broad casting top dressing, localized placement, contact placement, band placement, row placement, pellet, foliar application, starter solution and fertigation.		
Module: 8	**Contemporary Issues**	**2 hours**
Lecture by Industry Expert		
	Total Lecture hours:	**16**

Text Books	
1.	Jitendra Singh. Basic Horticulture. 2020. Kalyani Publishers. New Delhi.
2.	K. V. Peter. Basics of Horticulture: 3rd edition. 2017. New India Publishing Agency, India.
Reference Books	
1.	Kumar, N. Introduction To Horticulture, 7th edition. 2020. Oxford and IBH Publishers, India.
2.	Krishan Pal, Shubham Gupta, Kuldeep Kumar Bhargav and Abhay Saini. Fundamentals of Horticulture. 2023. S.R.Scientific Publication, India.
Mode of Evaluation: Mid-term, Assignments, FAT	

Indicative Experiments		
1.	Identification of garden tools	**2.5 hours**
2.	Identification of horticultural crops	**2.5 hours**
3.	Preparation of nursery beds- raised and flatbeds, sowing of seeds and seedlings	**2.5 hours**
4.	Practice of sexual methods of propagation	**2.5 hours**
5.	Micropropagation	**2.5 hours**
6.	Practice of asexual methods of propagation by divisions and cuttings	**2.5 hours**
7.	Practice of asexual methods of propagation by grafting	**2.5 hours**
8.	Practice of asexual methods of propagation by layering	**2.5 hours**
9.	Practice of asexual methods of propagation by budding	**2.5 hours**
10.	Training practices in fruit trees	**2.5 hours**
11.	Pruning practices in fruit trees	**2.5 hours**
12.	Layout and planning of orchard	**2.5 hours**
13.	Preparation of potting mixture, potting and repotting	**2.5 hours**
14.	Fertilizer application in horticultural crops	**2.5 hours**
15.	Visit to horticulture nursery	**2.5 hours**
16.	Visit to orchard	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Book	
1.	Arvind Kumar, Vipin Kumar, Satya Prakash, Bijendra Singh, Vibhu Pandey, Sachin Kumar. Practical Manual on Fundamentals of Horticulture. 2022. Pragathi Prakashan, India.
Reference Books	
1.	Balaji Vikram and Vipin Masih Prasad. Practical manual on fundamentals of horticulture and plant propagation. 2018. Write And Print Publications, India.
2.	Kumar, N. Introduction To Horticulture, 7th edition. 2020. Oxford and IBH Publishers, India.

Mode of Evaluation: Internal assessments, Final assessments			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	14-03-2024

Course Code	**Production Technology for Vegetables and Spices**	**L**	**T**	**P**	**C**
HORAG202		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamentals of Horticulture	1.0			

Course Objectives: The course is aimed at

1. Demonstrating the fundamental production technology of vegetables
2. Imparting knowledge on production technology of spices
3. Imparting practical experience on production technology of vegetables and spices

Course Outcomes: At the end of the course the student should be able to

1. Appreciate the importance of cultivating vegetables and spices
2. Demonstrate ideas on cultivating vegetables and spices
3. Understand physiological disorders undermining the yield of vegetables and spices
4. Plan for commercial cultivation of vegetables and spices
5. Cultivate vegetables
6. Demonstrate marketing of vegetables

Module:1	**Importance of Vegetables & Spices**	**2 hours**
Importance of vegetables and spices in human nutrition and national economy, classification of vegetables and spices, Kitchen gardening		
Module:2	**Solanaceous crops**	**2 hours**
Origin, area, climate, soil, improved varieties, time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, yield and physiological disorders of Tomato, Brinjal, Chilli, Capsicum and Potato -		
Module:3	**Cucurbitaceous and Bulb crops**	**2 hours**
Origin, area, climate, soil, improved varieties, time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, yield and physiological disorders of Cucumber, Melons, Gourds, Pumpkin, Onion and Garlic		
Module:4	**Cole and Leguminous Crops**	**2 hours**
Origin, area, climate, soil, improved varieties, time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, yield and physiological disorders of Cabbage, Cauliflower, Broccoli, Knol-Khol, French bean and Peas		
Module:5	**Root and Tuber Crops**	**2 hours**
Origin, area, climate, soil, improved varieties, time of sowing, transplanting techniques,		

planting distance, fertilizer requirements, irrigation, weed management, harvesting, yield and physiological disorders of Carrot, Radish, Beetroot Cassava, Colocasia and Elephant foot yam		
Module:6	**Leafy and Perennial Vegetables**	**2 hours**
Origin, area, climate, soil, improved varieties, time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, yield and physiological disorders Amaranthus, Palak, Moringa and Curry leaf.		
Module:7	**Spices**	**2 hours**
Origin, area, climate, soil, improved varieties, time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, yield and physiological disorders of Black pepper, Cinnamon, Turmeric, Ginger and Coriander		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Experts		
	Total Lecture hours:	**16**
Text Books		
1.	Roy, S., Thapa, U. and Karak, C. Production technology of vegetable and spices. 2023. Agro India Publications, India.	
2.	Kumar,N. Introduction to Spices, plantation crops medicinal and aromatic crops, .2021. Science and technology-Medtech Publishers, India.	
3.	Thamburaj, S. and Singh, N. Textbook of vegetable tuber crops and spices, 2014. ICAR, India.	
Reference Books		
1.	Bose, T.K., Som, M.G., Chattopadhyay, A. Maity, T.K and Kabir, J. Vegetable crops Vol-I,2,3 4th edition, 2021. Astral Publishing Authors Across the Globe, India.	
2.	Dhaliwal, M.S. Handbook of vegetable crops, 2018. Kalyani Publishers, India.	
Mode of Evaluation: Assignments, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Identification of vegetable crops and their seeds	**2.5 hours**
2.	Identification of spice crops and their seeds	**2.5 hours**
3.	Layout of kitchen garden	**2.5 hours**
4.	Nursery raising	**2.5 hours**
5.	Direct seed sowing and transplanting	**2.5 hours**
6	Study of morphological characters of vegetable crops	**2.5 hours**
7	Study of morphological characters of spice crops	**2.5 hours**
8	Fertilizer application in vegetable crops	**2.5 hours**
9	Irrigation management in vegetables	**2.5 hours**
10	Practices in use of plant growth regulators in vegetable crops	**2.5 hours**
11	Identification of physiological disorders in vegetable crops	**2.5 hours**
12	Study of maturity standards and harvesting of vegetables	**2.5 hours**
13	Harvest and post-harvest practices in spices	**2.5 hours**
14	Economics of vegetables cultivation	**2.5 hours**
15	Economics of spices cultivation	**2.5 hours**
16	Visit to commercial nurseries	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Books		
1.	Sable, P. A. and Sushma Sable. Spices crops of India, 2019. Jaya Publishing House, India.	

2.	Swarup, V. Vegetable Science and Technology in India, 2nd edition. 2020. Kalyani Publishers, New Delhi.
Reference Books	
1.	Rana, M.K. Fundamentals of Vegetable Production, 2020. New India Publishing Agency, India.
2.	Hazra, P. and Som, M.G. Vegetable science, 2015. Kalyani Publishers, India.

Mode of assessment: Internal assessments and Final assessment			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	Date	14-03-2024

Course Code	**Production Technology for Ornamental Crops, MAP and Landscaping**	**L**	**T**	**P**	**C**
HORAG203		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamentals of Horticulture	1.0			

Course Objectives: The course is aimed at

1. Explaining the principles of landscaping.
2. Imparting knowledge on the production technology of ornamental and medicinal plants.
3. Demonstrating practical applications of landscaping and producing ornamental and medicinal plants.

Course Outcomes: At the end of the course the student should be able to

1. Appreciate the importance of ornamental crops, MAPs and landscaping.
2. Understand principle of landscaping and design landscape.
3. Plan cultivation of cut and loose flowers.
4. Explain the values of cultivating medicinal and aromatic plants.
5. Interpret importance of value addition in ornamental crops and MAPs.

Module:1	**Importance and scope**	**2 hours**
Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping.		
Module:2	**Principles of Landscaping**	**2 hours**
Basic principles of landscaping: Background, contrast, balance, open centre, repetition, rhythm and variety. Uses of trees, shrubs and climbers in landscape designing.		
Module:3	**Cultivation under protected cultivation**	**2 hours**
Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions.		
Module:4	**Cultivation under open conditions**	**2 hours**
Production technology of gladiolus, tuberose, chrysanthemum, marigold and jasmine under open conditions.		
Module:5	**Cultivation of medicinal plants**	**2 hours**
Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol.		
Module:6	**Cultivation of aromatic plants**	**2 hours**
Production technology of important aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium and vetiver.		
Module:7	**Processing and value addition**	**2 hours**
Processing and value addition in ornamental crops and MAPs produce.		

Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**16**
Text Books		
1.	Sankaraswamy, J. Comprehensive Floriculture, 2018. Narendra Publishing House, India	
2.	Singh, A.K. Textbook of floriculture and landscaping, 2017. New India Publishing Agency, India	
3.	Balaji S. Kulkarni. Floriculture and Landscaping. 2016. Agro India publications, India.	
Reference Books		
1.	Mishra, R.L. and Misra, S. Commercial ornamental crop loose flowers. 2023. Daya publishing House, New Delhi, India.	
2.	G. S. Randhawa, G.S. and Mukhopadhyay, A. Floriculture in India. 2022. Allied Publishers private limited, India.	
3.	Bose, T. K., Singh, L. J., Sadhu, M.K. and Maity. T.K. Ornamental Plants and Garden Design in Tropics and Subtropics (2 Vols.). 2015. Astral International Ltd., India.	
Mode of Evaluation: Assignments, Mid-Term, and Final assessment test		
Indicative Experiments		
1.	Identification of ornamental plants -Flowering	**2.5 hours**
2.	Identification of ornamental plants – Non Flowering	**2.5 hours**
3.	Identification of medicinal plants	**2.5 hours**
4.	Identification of aromatic plants	**2.5 hours**
5.	Identification of varieties in cut flowers	**2.5 hours**
6.	Identification of varieties in loose flowers	**2.5 hours**
7.	Nursery bed preparation and seed sowing of flower crops	**2.5 hours**
8.	Training and pruning of ornamental plants	**2.5 hours**
9.	Planning and layout of garden	**2.5 hours**
10	Lawn and lawn-making	**2.5 hours**
11	Bed preparation and planting of MAPs	**2.5 hours**
12	Protected structures: care and maintenance	**2.5 hours**
13	Intercultural operations in flowers and MAPs	**2.5 hours**
14	Harvesting and post-harvest handling of cut and loose flowers	**2.5 hours**
15	Processing of MAPs	**2.5 hours**
16	Visit to commercial flower/MAPs unit	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Books		
1.	Jagetiya, B.L. and Laxmi, L. Textbook of commercial floriculture, 2020. Agrotech. India.	
2.	Lakshmi Lal. Textbook of Production Technology for Ornamental Crops MAPs and Landscaping. 2018. Agro tech Publishing Academy, India.	
Reference Books		
1.	Mishra, R.L. and Misra, S. Commercial ornamental crop loose flowers. 2023. Daya publishing House, New Delhi, India.	
3.	Charles P. Griner, Colquitt County H.S. and Moultrie, G.A. Floriculture: Designing and Merchandising, 4th edition. 2019. Cengage Learning, USA.	

Mode of assessment: Internal assessments and Final assessment			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	Date	14-03-2024

Course Code	**Production Technology for Fruit and Plantation crops**	**L**	**T**	**P**	**C**
HORAG204		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamentals of Horticulture	1.0			

Course Objectives: The course is aimed at

1. Demonstrating production technology of fruit crops.
2. Explaining the production technology of plantation crops.
3. Imparting practical experience on production technology of fruit and plantation crops.

Expected Course Outcomes: At the end of the course the student should be able to

1. Analyze the scope of cultivating a fruit or plantation crop
2. Define package of practices followed for tropical fruits
3. Comprehend technology involved in growing sub-tropical fruits
4. Define package of practices followed for minor fruits and plantation crops
5. Develop one's career interest in pomiculture and plantation crops
6. Design an orchard

Module:1	**Fruit and plantation Crops-Scope and Importance**	**2 hours**

Importance and scope of fruit and plantation crop industry in India. Nutritional, commercial, Industrial and medicinal importance of fruit and plantation crops. High density planting; Use of rootstocks.

Module:2	**Production technology of Tropical fruits**	**3 hours**

Production technologies for the cultivation of major fruits: Mango, Banana, Guava, Papaya and Sapota. Soil and climate, propagation, varieties and cultivars; Planting, nutrient and water management, Inter cultural operations, maturity, harvesting and yield; Physiological disorders, pests and diseases and their management practices.

Module:3	**Production technology of Subtropical fruits**	**2 hours**

Production technologies for the cultivation of major fruits: Citrus, Grape and Litchi. Soil and climate, propagation, varieties and cultivars; Planting, nutrient and water management, Inter cultural operations, maturity, harvesting and yield; Physiological disorders, pests and diseases and their management practices.

Module:4	**Production technology of temperate fruits**	**2 hours**

Production technologies for the cultivation of major fruits: Apple, Peach, Pear, Walnut and Almond. Soil and climate, propagation, varieties and cultivars; Planting, nutrient and water management, Inter cultural operations, maturity, harvesting and yield; Physiological disorders, pests and diseases and their management practices.

Module:5	**Production technology of arid and semi-arid fruits**	**1 hours**

Production technologies for the cultivation of Date palm and Ber. Soil and climate, propagation, varieties and cultivars; Planting, nutrient and water management, Inter cultural operations, maturity, harvesting and yield; Physiological disorders, pests and diseases and their management practices.

Module:6	**Production technology of Minor fruits**	**2 hours**

Production technologies for the cultivation of Pineapple, Pomegranate, Jackfruit,

Strawberry. Soil and climate, propagation, varieties and cultivars; Planting, nutrient and water management, Inter cultural operations, maturity, harvesting and yield; Physiological disorders, pests and diseases and their management practices.		
Module:7	**Production technology of plantation crops**	**2 hours**
Production technologies for the cultivation of Coconut, Areca nut, Cashew, Tea, Coffee and Rubber. Soil and climate, propagation, varieties and cultivars; Planting, nutrient and water management, Inter cultural operations, maturity, harvesting and yield; Physiological disorders, pests and diseases and their management practices.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**
Text Books		
1.	T.K. Chattopadhaya. A Text Book of Pomology Vol.-II (Tropical fruits), 2015, Kalyani Publishers, India.	
2.	T.K. Chattopadhaya. A Text Book of Pomology Vol.-III (Sub-Tropical fruits), 2015, Kalyani Publishers, India.	
Reference Books		
1.	Chadha K. L. Handbook of Horticulture in 2 Vols 2nd Revisied edition, 2019. DSR Book Distributors, India.	
2.	T. Radha, Lila Mathews and K Ajith Kumar. Fruit Crops: Vol.03: Horticulture Science Series: 2nd Fully Revised Edition, 2019. New India Publishing Agency, India.	
Mode of Evaluation: Mid-term, Assignments, FAT		
Indicative Experiments		
1.	Seed propagation, scarification and stratification of seeds	**2.5 hours**
2.	Description and identification of fruit crops	**2.5 hours**
3.	Description and identification of plantation crops	**2.5 hours**
4.	Propagation techniques, selection of planting material and varieties for tropical fruits	**2.5 hours**
5.	Propagation techniques, selection of planting material and varieties for subtropical and temperate fruits	**2.5 hours**
6.	Micropropagation, protocol for mass multiplication and hardening of fruit crops	**2.5 hours**
7.	Identification and description of varieties, nursery practices of coconut, arecanut and cashewnut	**2.5 hours**
8.	Identification and description of varieties- nursery practices, training and pruning, processing of tea, coffee and rubber	**2.5 hours**
9.	Special horticultural practices in fruit crops	**2.5 hours**
10.	Preparation of plant bio regulators and their uses	**2.5 hours**
11.	Pests of fruit crops	**2.5 hours**
12.	Pests of plantation crops	**2.5 hours**
13.	Diseases of fruit crops	**2.5 hours**
14.	Diseases of plantation crops	**2.5 hours**
15.	Physiological disorders of fruit and plantation crops	**2.5 hours**
16	Visit to commercial orchards/plantation industries	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book(s)		
1.	J.S. Bal. Tropical Fruits: Vol.02: Fruit Science Culture & Technology. 2017. New India Publishing Agency, India.	

2.	K. Vanangamudi, N. Cezhiyan, M. Kokila and M. Prabhu. Handbook of Horticultural Sciences: Vol.01: Principles and Practices of Horticulture and Fruit Science, 2023. New India Publishing Agency, India.
Reference Books	
1.	Kumar, N. Introduction to Spices, Plantation crops, Medicinal and Aromatic Plants. 2017. Medtech; Standard Edition, India.
2.	T. Radha, Lila Mathews and K Ajith Kumar. Fruit Crops: Vol.03: Horticulture Science Series: 2nd Fully Revised Edition, 2019. New India Publishing Agency, India.

Mode of assessment: Internal assessments and FAT			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	Date	14-03-2024

Course Code	**Post-Harvest Management and Value Addition of Fruits and Vegetables**	**L**	**T**	**P**	**C**
HORAG307		**1**	**0**	**2**	**2**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamentals of Horticulture	1.0			

Course Objectives: The course is aimed at

1. Describing the role of post-harvest technology in extending shelf life of agricultural produces
2. Improving the knowledge and need on value addition in agro-processing
3. Developing hands on training on processing of different fruits and vegetable products

Expected Course Outcome: At the end of the course the student should be able to

1. Discuss on the importance of post-harvest management of crops
2. Analyze effective methods of storage of the harvested produce
3. Define processing and value addition of harvested crop produces
4. Formulate and describe packaging of value-added products from fruits and vegetables
5. Develop entrepreneur skills and discover ideas to process fruits and vegetables

Module:1	**Post-harvest processing**	**2 hours**
Importance of post-harvest processing of fruits and vegetables, extent and possible factors of post- harvest losses.		
Module:2	**Pre-harvesting**	**2 hours**
Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate		
Module:3	**Harvesting and storage**	**2 hours**
Harvesting and field handling; Methods of storage-precooling, ZECC, cold storage, controlled atmosphere storage, modifiedatmospheric storage and hypobaric storage.		
Module:4	**Preservation**	**3 hours**
Concept of value addition; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy-concepts and standards		
Module:5	**Value addition**	**2 hours**
Concepts and Standards; Fermented and non-fermented beverages. Tomato products-Concepts and Standards		
Module:6	**Drying/Dehydration**	**2 hours**
Drying/Dehydration of fruits and vegetables-concept and methods, osmotic drying		

Module:7	**Canning and packaging**	**1 hour**
Canning- concepts and standards, packaging of products		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**16**
Text Book		
1.	R. P. Srivastava and S. Kumar. Fruit and Vegetable Preservation, Principles and Practices, 2017. Agrobios, India.	
Reference Books		
1.	Muhammad Siddiq and Mark A. Uebersax. Handbook of vegetables and vegetable processing, 2nd edition- 2 vol. set. 2018. Wiley-Blackwell, USA.	
2.	K Prakash and S Chandraprabha. Post Harvest Technology and Value Addition of Fruits and Vegetables. 2020. LAP Lambert Academic Publishing, Germany.	
Mode of Evaluation: Mid-term, Assignments, FAT		
Indicative Experiments		
1.	Applications of different types of packaging, containers for shelf-life extension	**2.5 hours**
2.	Effect of temperature on shelf life and quality of produce	**2.5 hours**
3.	Demonstration of chilling and freezing injury in vegetables and fruits	**2.5 hours**
4.	Extraction and preservation of pulps and juices	**2.5 hours**
5.	Preparation of fruit jam	**2.5 hours**
6.	Preparation of Jelly	**2.5 hours**
7.	Preparation of RTS and nectar	**2.5 hours**
8.	Preparation of squash and syrup	**2.5 hours**
9.	Preparation of osmotically dried products	**2.5 hours**
10.	Preparation of fruit bar and candy	**2.5 hours**
11.	Preparation of tomato sauce and ketchup	**2.5 hours**
12.	Preparation of pickle	**2.5 hours**
13.	Preparation of canned products	**2.5 hours**
14.	Quality evaluation of products- physicochemical properties	**2.5 hours**
15.	Quality evaluation of products- sensory evaluation	**2.5 hours**
16	Visit to processing unit/ industry.	**2.5 hours**
	Total Laboratory Hours	**40**
Text Books		
1.	R. P. Srivastava and S. Kumar. Fruit and Vegetable Preservation, Principles and Practices, 2017. Agrobios, India.	
2.	Jyostnarani Pradhan and Dr. Savita Jangde. Post-Harvest Physiology of Fruits and Vegetables. 2018. Practical Manual. New Delhi Publisher, India.	
Reference Books		
1.	Ankur M. Arya, Tarun Kumar, Suresh Chandra. Practical Manual on Post Harvest Management and Value Addition of Fruits and Vegetables. 2020. Jain Brothers, India.	
Mode of assessment: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No. 73	**Date** 14-03-2024

Food Science & Technology

Course Code	Course Title	Course Type	L	T	P	C	Prerequisite
FSNAG301	Principles of Food Science and Nutrition	Embedded T & L	2	0	0	2	None

Course code	Principles of Food Science and Nutrition		L	T	P	C
FSNAG301			2	0	0	2
Pre-requisite	None	Syllabus version				
		1.0				

Course Objectives: The course is aimed at

1. Understanding the concept of nutrients, diet and health
2. Demonstrating different techniques for food processing and preservation
3. Discussing food composition and chemistry

Expected Course Outcome: At the end of the course the student should be able to

1. Discuss about various food groups, balanced diet, meal planning
2. Describe digestion, absorption and functions of various nutrients and their sources
3. Enumerate the reasons for spoilage and describe the principles of various unit operations for food preservation

Module:1	**Basics of Food and Nutrition**	**4 hours**
Basic terms used in food and nutrition, Malnutrition (over and under nutrition), nutritional disorders, Balanced/ modified diets, Menu planning, New trends in food science and nutrition		
Module:2	**Food Composition and Chemistry**	**5 hours**
Classification, structure, functions and important reactions of water, carbohydrates, proteins and fats; Energy metabolism of carbohydrates, proteins and fats		
Module:3	**Minor food components and Chemistry**	**4 hours**
Classification, structure, functions and important reactions of vitamins, minerals, flavours, colours and miscellaneous bioactive compounds		
Module:4	**Concepts of Food Science**	**4 hours**
Definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems		
Module:5	**Food microbiology**	**4 hours**
Bacteria, yeast, moulds, spoilage of fresh foods, spoilage of processed foods; Production of fermented foods(bread, cheese, beer)		
Module:6	**Food Processing and Preservation**	**5 hours**
Principles and methods of use of heat, low temperature, chemicals		
Module:7	**Principles and methods of food processing**	**4 hours**
Principles and methods of use of radiations, additives and drying		
Module:8	**Contemporary Issues**	**2 hours**
Lecture from industry expert		
	Total Lecture hours:	**32**

Text Book

1.	R S Aggarwal. Senior Secondary School Mathematics for Class 12. 2020. Bharati Bhawan (Publishers & Distributors), India.

Reference Books

1.	Lewingdon Parsons, G. Elementary Differential and Integral Calculus. 2017. Cambridge University Press Publishing Company, UK
2.	Grewal, B.S. 2015. Higher engineering mathematics.43rd edition. Khanna Publishers. India.

Mode of assessment: Assignment, Mid-semester and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Agricultural Extension and Communication							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
AEXAG101	Rural Sociology and Educational Psychology	Theory	2	0	0	2	None
AEXAG102	Fundamentals of Agricultural Extension Education	Embedded T & L	2	0	2	3	None
AEXAG103	Communication Skills and Personality Development	Embedded T & L	1	0	2	2	None
AEXAG304	Entrepreneurship Development and Business Communication	Embedded T & L	1	0	2	2	None

Course code	**Rural Sociology and Educational Psychology**	**L**	**T**	**P**	**C**
AEXAG101		**2**	**0**	**0**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Explaining the structure and functioning of rural societies in India
2. Discussing the role of human behaviour in effecting constructive changes for rural development
3. Imparting knowledge of educational psychology

Expected Course Outcome: At the end of the course the student should be able to

1. Classify rural social groups and describe social values of India
2. Plan social and behavioural change using agricultue based development programs
3. Assess farmers based on personality determinants; Bring in new extension activities suitable for the society

Module:1	**Introduction to sociology**	**4 hours**

Definition and scope of sociology and rural sociology and its significance in agricultural extension. Social groups: classification, factors considered in the formation of group

Module:2	**Indian rural society**	**6 hours**

Basis and forms of rural social stratifications. Characteristics and differences between class and caste systems. Cultural concept: customs, folkways, mores, taboos and

rituals. Social values in rural societies		
Module:3	**Social Institution and Social Organization**	**4 hours**
Social Institution: family, village panchayat, co-operatives, their functions and significance in agricultural extension. Social organization: types, characteristics and relevance to social institutions.		
Module:4	**Social Change and Development**	**4 hours**
Rural social changes: processes and factors of transformation. Concepts of social ecology and its comparison to traditional rural values. Planned social change: approaches to rural planning and Indian rural development programs (IRDPs). Status and role of women in agriculture and rural development		
Module:5	**Educational psychology**	**4 hours**
Meaning, scope and its importance in agricultural extension. Cognitive, affective, and psychomotor domains of learning.		
Module:6	**Intelligence**	**4 hours**
Intelligence: meaning, types, measurement, Intelligence tests, factors affecting intelligence.		
Module:7	**Personality and Behaviour**	**4 hours**
Motivation: definition, theories, modes of motivation, the relationship of motivation with behavioural traits and humanistic personality patterns. Persistence and changes in personality determinants: physical, intellectual, emotional, social, educational and family.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**32**

Text Books	
1.	Chitambar, J.B. Introductory Rural Sociology. 3rd edition, 2018. New Age International Private Limited, India.
2.	Anita. Woolfolk and Vij Shivani. Educational Psychology. 13th edition, 2017. Pearson Education, India.
Reference Books	
1.	D. K. Meena, Sonika Sharma and Diksha Sharma. Introduction to Rural Sociology and Educational Psychology. 2022. S.R. Scientific Publications, India
2.	Sagar Mondal.Textbook of Rural Sociology and Educational Psychology (Theory and Practice). 2018. Kalyani Publishers, India

Mode of assessment: Assignment, Mid-semester and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Fundamentals of Agricultural Extension Education**	**L**	**T**	**P**	**C**
AEXAG102		**2**	**0**	**2**	**3**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Providing information on the concepts of agricultural extension education and development programmes offered in India
2. Imparting knowledge on rural development, leadership, technology transfer, extension teaching, agricultural journalism and effective communication through

media
3. Discussing on extension programme monitoring and evaluation.

Expected Course Outcome: At the end of the course the student should be able to

1. Realize the necessity of agricultural extension for rural development
2. Acquire knowledge on extension systems in India
3. Devise plans for rural community development; plan and evaluate an extension programme
4. Transfer technology and innovations towards agricultural development
5. Develop interest in agricultural journalism
6. Disseminate information and technology through audio visual aids

Module:1	**Extension education**	**4 hours**
Meaning and definition of education and its types; meaning of extension education, definition, scope, process, objectives, and principles. Meaning, process, principles, and steps in extension programme planning and development.		
Module:2	**Extension systems in India**	**4 hours**
Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project; Nilokheri Experiment)		
Module:3	**Extension/ Agriculture development programmes**	**4 hours**
Extension/ Agricultural development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP)		
Module:4	**New trends in Agricultural extension**	**4 hours**
Privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension and expert systems		
Module:5	**Rural and Community Development**	**4 hours**
Concept, meaning and definition of rural development and various rural development programmes launched by Government of India. Meaning, definition, concept, principles and philosophy of community development. Concept, definition and types of leaders in rural context. Meaning, concept, principles and functions of extension administration. Concept, definition, monitoring and evaluation of extension programmes.		
Module:6	**Teaching, communication and transfer of technology**	**6 hours**
Transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition: principles and Functions of Communication, models and barriers to communication		
Module:7	**Agricultural Journalism and the process of adoption**	**4 hours**
Agricultural journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**32**

Text Books

1. Ray, G.L. Extension Communication and Management. 8th edition, 2022. Kalyani Publishers, India.
2. Sagar Mondal. Fundamentals of Agricultural Extension Education. 2019.Kalyani Publishers, India.

Reference Books		
1.	Sunil V.G. Fundamentals of Agricultural Extension. 2022. New Vishal Publications, India	
2.	Satwik Sahay Bisarya. Agriculture journalism. 2022. Notion Press, India	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
17.	To get acquainted with university extension system	**2.5 hours**
18.	Group discussion- exercise	**2.5 hours**
19.	Handling and use of audio visual equipments and digital camera and LCD projector	**2.5 hours**
20.	Preparation and use of AV aids	**2.5 hours**
21.	Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories	**2.5 hours**
22.	Presentation skills exercise	**2.5 hours**
23.	Micro teaching exercise	**2.5 hours**
24.	A visit to village to understand the problems being encountered by the villagers/ farmers	**2.5 hours**
25.	To study organization and functioning of DRDA	**2.5 hours**
26.	Visit to State Department of Agriculture to understand the organizational setup, roles, functions and various schemes.	
27.	Visit to NGO and learning from their experience in rural development	**2.5 hours**
28.	Understanding PRA techniques and their application in village development planning	**2.5 hours**
29.	Visit to community radio studio and understand programme production	**2.5 hours**
30.	Visit to television studio and understand programme production	**2.5 hours**
31.	Script writing for print and electronic media	**2.5 hours**
32.	Developing script for radio and television	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	Renu Arya et al. Fundamentals of Agricultural Extension. 2022. Scientific Publishers, India.	
Reference Books		
1.	Francis Lelo, J. O. Ayieko, and R. Njeri Muhia. Participatory Rural Appraisal Approaches: A Resource for Trainers and Practitioners. 2021. Moran (E.A.) Publishers Limited, Kenya	
2.	Satwik Sahay Bisarya. Agriculture journalism. 2022. Notion Press, India	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73	**Date** 14-03-2024

Course code	**Communication Skills and Personality Development**	**L**	**T**	**P**	**C**
AEXAG103		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			
Course Objectives: The course is aimed at					

1. Describing the importance of effective communication
2. Imparting knowledge on precis writing and summarizing
3. Enhancing the communication skills and personality of students

Expected Course Outcome: At the end of the course the student should be able to

1. Understand the concept, process and importance of communication.
2. Gain knowledge of media of communication.
3. Develop skills of effective communication both written and oral
4. Acquaint themselves with the application of communication skills in the world of business.
5. Realise the concept of personality development and its significance.
6. Develop various traits required for personality development.

Module:1	**Communication**	**2 hours**
Structural and functional grammar, parts of speech, Sentence structure, communication concepts and process, verbal and nonverbal communication		
Module:2	**Listening, writing and oral presentation**	**2 hours**
Listening, developing listening skills, art of listening, note taking, effective writing, technical writing and oral presentation skills		
Module:3	**Field diary and Indexing**	**2 hours**
Field diary, Lab record, indexing, Foot notes, using footnotes, bibliographic procedures-citations; Paraphrasing		
Module:4	**Reading and comprehension**	**2 hours**
Reading skills, comprehension skills, decoding skills and critical reading skills of general and technical articles		
Module:5	**Precis writing and summarizing**	**2 hours**
Precis writing, referencing, abstracting; Purpose of abstracts, types of abstracts and styles; Summarizing articles		
Module:6	**Individual and group presentations**	**2 hours**
Starting a presentation, state the purpose of your presentation, dealing with questions; Rhetorical questions, cause and effect; Impromptu presentation; Public speaking for technical sessions		
Module:7	**Group discussion, organising seminars and conferences**	**2 hours**
Group discussion; Planning and conducting a meeting; Organising seminars and conferences		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**16**

Text Books

1. Sagar Mondal. Communication Skills and Personality Development.2021. Kalyani Publishers, India.
2. Rajashekhar M Yarbagi. An Introduction to Communication Skills and Personality Development.2018.Laxmi Book Publications, India

Reference Books

1. Anubhuti Dubey and Aradhna Shukla. Personality Development and Communication Skills.2023. Laxmi Publications Pvt. Ltd., India
2. Gupta, C.B. Personality Development and Communication Skill-I.2014.8th Edition, Scholar Tech Press, India

Mode of assessment: Assignment, Mid-semester and Final assessment test

Indicative Experiments		
1.	Practicing active listening	**2.5 hours**
2.	Exercise on note taking methods	**2.5 hours**
3.	Exercise on technical writing and practicing proof correction	**2.5 hours**
4.	Practicing oral presentation	**2.5 hours**
5.	Exercise on writing field diary and Lab record	**2.5 hours**
6.	Visit to library and learn indexing	**2.5 hours**
7.	Exercise in preparing footnote and citations	**2.5 hours**
8.	Practice on effective reading skills	**2.5 hours**
9.	Comprehension of technical articles	**2.5 hours**
10.	Comprehension of general articles	**2.5 hours**
11.	Exercise on precise writing	**2.5 hours**
12.	Practice in summarizing articles	**2.5 hours**
13.	Practice in preparing abstracts	**2.5 hours**
14.	Developing skills in individual presentation-I	**2.5 hours**
15.	Developing skills in individual presentation-II	**2.5 hours**
16.	Developing skills in group presentation	**2.5 hours**
	Total Laboratory Hours	**40**

Text Book	
1.	J.R. Kadam, V.G. Patil, S.A. Dhenge and A.M. Murai. Communication Skills and Personality Development. 2018. Scientific Publishers, India
Reference Books	
1.	Ray, G.L. Extension Communication and Management. 2022. 8th edition, Kalyani Publishers, India.
2.	Kumar Varinder. Communication Skills and Personality Development. 2017. Kalyani Publishers, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Entrepreneurship Development and Business Communication**	**L**	**T**	**P**	**C**
AEXAG304		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Explaining entrepreneurship development
2. Imparting managerial and project planning skills
3. Describing supply chain management in agriculture

Expected Course Outcome: At the end of the course the student should be able to

1. Acquire knowledge on entrepreneurship development
2. Comprehend emerging business / entrepreneurial environment
3. Develop organizational, managerial, problem-solving and project planning skills
4. Understand supply chain management in agriculture
5. Comprehend total quality management
6. Develop agri-business projects

Module:1	**Entrepreneurship Development**	**2 hours**
Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Impact of economic reforms on Agribusiness/ Agri enterprises, Entrepreneurial Development Process.		
Module:2	**Government policies**	**2 hours**
Government programs and institutions for entrepreneurship development; Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to agriculture sector		
Module:3	**Globalization & entrepreneurial environment**	**2 hours**
Globalization and the emerging business / entrepreneurial environment; Generation, incubation and commercialization of ideas and innovations. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of agri inputs industry. Characteristics.		
Module:4	**Business Leadership Skills**	**2 hours**
Business Leadership Skills; Developing organizational skill - controlling, supervising, problem-solving, monitoring & evaluation, Developing Managerial skills, Business Leadership Skills - Communication, direction and motivation Skills; Problem-solving skills		
Module:5	**Supply chain management**	**2 hours**
Supply chain management: Integrated Agri-supply chain management; Supply Chain Management in Horticulture, Dairy and Poultry.		
Module:6	**Total quality management**	**2 hours**
Total quality management: Total Quality Management Principles, Total Quality Management Methodologies, Key Concepts, Steps, Tools.		
Module:7	**Project Planning**	**2 hours**
Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agrientrepreneurship and rural enterprise.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**16**

Text Books	
1.	Charantimath Poornima, M. Entrepreneurship Development and Small Business Enterprises. 3rd edition, 2018. Pearson Education, India.
2.	Michael Laverty & Chris Little. Entrepreneurship, 2020. OpenStax, Rice University, USA.
Reference Books	
1.	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd. Entrepreneurship. 10th edition, 2017. McGraw-Hill Education, USA.
2.	Annamaria Bliven. Entrepreneurship Essentials You Always Wanted To Know (Self-Learning Management), 2023. Vibrant Publishers. India.

Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Assessment of Entrepreneurial Traits	**2.5 hours**
2.	Assessing Problem Solving Skills	**2.5 hours**
3.	Assessing Leadership skills	**2.5 hours**
4.	Developing managerial skills	**2.5 hours**
5.	How to Assess Achievement Motivation	**2.5 hours**
6.	How Creative Are You?	**2.5 hours**
7.	Time audit through planning	**2.5 hours**
8.	Time audit through monitoring	**2.5 hours**
9.	Time audit through supervision	**2.5 hours**
10.	Identification and selection of business idea	**2.5 hours**
11	Preparation of business plan	**2.5 hours**
12	Proposal writing	**2.5 hours**
13	Visit to entrepreneurship development institute	**2.5 hours**
14	Visit to agri enterprises	**2.5 hours**
15	Visit to agri enterprises	**2.5 hours**
16	Interaction with entrepreneurs	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Books		
1.	Charantimath Poornima, M. Entrepreneurship Development and Small Business Enterprises. 3rd edition, 2018. Pearson Education, India.	
2.	Michael Laverty & Chris Little. Entrepreneurship, 2020. OpenStax, Rice University, USA.	
Reference Books		
1.	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd. Entrepreneurship, 10th edition, 2017. McGraw-Hill Education, USA.	
2.	Annamaria Bliven. Entrepreneurship Essentials You Always Wanted To Know (Self-Learning Management), 2023. Vibrant Publishers, India.	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28/02/2024	
Approved by Academic Council	No.73 **Date**	14/03/2024

Biochemistry / Physiology / Microbiology/ Environmental Sciences							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
BICAG101	Fundamentals of Plant Biochemistry and Biotechnology	Embedded T & L	2	0	2	3	None
CRPAG101	Fundamentals of Crop Physiology	Embedded T & L	1	0	2	2	None
AGMAG101	Agricultural Microbiology	Embedded T & L	1	0	2	2	None
ENSAG201	Environmental Studies &	Embedded T & L	2	0	2	3	None

	Disaster Management						
FORAG101	Introduction to Forestry	Embedded T & L	1	0	2	2	None

Course Code	**Fundamentals of Plant Biochemistry & Biotechnology**	**L**	**T**	**P**	**C**
BICAG101		**2**	**0**	**2**	**3**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the structure and function of biomolecules
2. Illustrating primary metabolic pathways in plants
3. Describing basic plant biotechnological applications viz., tissue culture, transgenics and marker assisted breeding

Course Outcomes: At the end of the course the student should be able to

1. Interpret the importance of biomolecules
2. Describe the role and metabolism of lipids
3. State the structure and functions of nucleic acids
4. Develop interest in micropropagating plants
5. Define biotechnological techniques involved in breeding plants
6. Analyze and interpret biochemical data

Module:1	**Biochemical Foundations**	**2 hours**
Importance of biochemistry, properties of water, pH and buffer.		
Module:2	**Carbohydrates**	**6 hours**
Carbohydrate: Importance and classification. Structures of monosaccharides, reducing and oxidizing properties of monosaccharides, mutarotation; structure of disaccharides and poly saccharides. Glycolysis, TCA cycle, glyoxylate cycle and electron transport chain.		
Module:3	**Lipids**	**4 hours**
Importance and classification of lipids; structures and properties of fatty acids. Storage lipids and membrane lipids. Beta oxidation and biosynthesis of fatty acids.		
Module:4	**Proteins**	**4 hours**
Importance of proteins and classification. Structures, titration and zwitterions nature of amino acids. Structural organization of proteins. General properties, classification and mechanism of action of enzymes. Michaelis&Menten and Line Weaver Burk equation & plots. Introduction to allosteric enzymes.		
Module:5	**Nucleic acids**	**4 hours**
Importance and classification of nucleic acid. Structure of nucleotides, A, B & Z DNA; RNA: Types, secondary and tertiary structure.		
Module:6	**Plant tissue culture and its applications**	**6 hours**
Scope, concepts and applications of plant biotechnology. Totipotency, plasticity and culture types and their applications: organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture. Micro-propagation methods, organogenesis and embryogenesis. Synthetic seeds and their significance; Embryo rescue and its significance; Somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; Cryo-preservation.		
Module:7	**Transgenics and marker assisted breeding**	**4 hours**
Introduction to recombinant DNA methods: physical (Gene gun method), chemical		

(PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**
Text Books		
1.	David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry: International Edition. 2017. 7th edition, W.H. Freeman. USA.	
2.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger and Anthony Bretscher. Molecular Cell Biology. 2021. 8th edition, W.H. Freeman. USA	
Reference Books		
1.	Buchanan. B. B. Biochemistry and Molecular Biology of Plants. 2nd Edition. 2015. Wiley- Blackwell, USA.	
2.	Lincoln Taiz, Eduardo Zeiger, Ian M. Moller, and Angus Murphy. Plant Physiology and Development, International Sixth Edition. 2018. Sinauer; Oxford University Press; USA.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Basic Pipetting Techniques	**2.5 hours**
2.	Preparation of Biological Solutions	**2.5 hours**
3.	Preparation of Buffers	**2.5 hours**
4.	Quantitative Estimation of Proteins	**2.5 hours**
5.	Quantitative Estimation of Reducing Sugars	**2.5 hours**
6.	Separation of Amino Acids by Paper Chromatography	**2.5 hours**
7.	General Procedures for Qualitative Analysis of Carbohydrates	**2.5 hours**
8.	Titration method for estimation of lipids	**2.5 hours**
9.	Effect of pH, temperature and substrate concentration on enzyme action	**2.5 hours**
10.	Sterilization techniques for Plant Tissue Culture	**2.5 hours**
11.	Media Preparation for Plant Tissue Culture	**2.5 hours**
12.	Preparation of stock solutions for MS nutrient medium	**2.5 hours**
13.	Callus Induction / Organogenesis from Paddy and Sorghum	**2.5 hours**
14.	Isolation of Plant Genomic DNA by cTAB method	**2.5 hours**
15.	Demonstration of Gel Electrophoresis techniques	**2.5 hours**
16.	DNA finger printing	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry: International Edition. 2017. 7th edition, W.H. Freeman. USA.	
Reference Books		
1.	Buchanan. B. B. Biochemistry and Molecular Biology of Plants. 2nd Edition. 2015. Wiley- Blackwell, USA.	
2.	Lincoln Taiz, Eduardo Zeiger, Ian M. Moller, and Angus Murphy. Plant Physiology and Development, International 6th edition. 2018. Sinauer; Oxford University Press; USA.	

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	Date	14-03-2024

Course Code	**Fundamentals of Crop Physiology**	**L**	**T**	**P**	**C**
CRPAG101		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Instilling information on basic plant physiological functions, processes and its importance in crop production.
2. Infusing knowledge on growth and development, and to make the students understand how knowledge about these concepts has led to improved productivity in modern agriculture.
3. Imparting knowledge on remedy measures involved in solving plant physiological problems.

Course Outcomes: At the end of the course the student should be able to

1. Define different physiological process at plant and cellular level
2. Summarize mechanisms of uptake, transport and translocation of water and nutrients
3. Distinguish carbon cycles in plants and define lipid metabolism
4. Relate the importance of growth regulators in plant growth
5. Explain nutrient deficiencies and physiological requirements of plants
6. Interpret and measure plant physiological data

Module:1	**Physiology and cell biology of plants**	**2 hours**
Crop physiology and its importance in agriculture. Overview of plant cell: biomembrane, organelles and the cytoskeleton.		
Module:2	**Plant Water Relation**	**2 hours**
Active and passive absorption of water. Diffusion and osmosis. Water potential and its importance. Stomatal Physiology, transpiration and water use efficiency.		
Module:3	**Mineral Nutrition and BNF**	**2 hours**
Mengel`s classification of mineral nutrients in plants. Nutrient uptake mechanisms. Functional roles and deficiency symptoms of macro and micro nutrients.		
Module:4	**Photosynthesis and Respiration**	**2 hours**
Photosynthesis: Light and dark reactions - C3, C4 and CAM; Respiration: Glycolysis, TCA cycle and electron transport chain.		
Module:5	**Lipid Metabolism**	**2 hours**
Fat Metabolism. Fatty acid synthesis and breakdown.		
Module:6	**Plant Growth Regulators**	**2 hours**
Auxins, cytokinins, gibberellins, abscisic acid and ethylene-physiological roles and agricultural uses.		
Module:7	**Growth Analysis**	**2 hours**
Physiological aspects of growth and development of major crops - growth analysis androle of physiological growth parameters in crop productivity.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		

	Total Lecture hours:	**16**
Text Book(s)		
1.	Lincoln Taiz, Eduardo Zeiger, Ian M. Moller, and Angus Murphy. 2018. Plant Physiology and Development, International 6th edition. Sinauer; Oxford University Press; USA.	
2.	V.K. Jain. Fundamentals of Plant Physiology, 19th edition. 2017. S Chand Publishing, India.	
Reference Books		
1.	Buchanan. B. B. Biochemistry and Molecular Biology of Plants. 2nd Edition. 2015. Wiley- Blackwell, USA.	
2.	Willey, N. Environmental Plant Physiology, 1st edition, 2016. Garland Science, Taylor and Francis Group, LLC, UK.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Study of plant cells; permanent slide studies on anatomy of C3 and C4 leaves	**2.5 hours**
2.	Determination of stomatal frequency and index studies	**2.5 hours**
3.	Imbibition and seed germination studies	**2.5 hours**
4.	Demonstration of osmosis and plasmolysis	**2.5 hours**
5.	Separation of chloroplast pigments by paper chromatography	**2.5 hours**
6.	Measurement of chlorophyll using the SPAD meter	**2.5 hours**
7.	Measurement of root pressure in plants	**2.5 hours**
8.	Extraction of chlorophyll; Measurement of absorption spectrum of chloroplast pigments	**2.5 hours**
9.	Measurement of photosynthesis in plants	**2.5 hours**
10.	Estimation of relative water content	**2.5 hours**
11.	Tissue test for mineral nutrients	**2.5 hours**
12.	Measurement of photosynthetic CO_2 assimilation by infra-red gas analyzer (IRGA) (li-6800)	**2.5 hours**
13.	Chlorophyll fluorescence measurements using minipam fluorometer	**2.5 hours**
14.	Measurement of canopy temperature by infra-red thermometer	**2.5 hours**
15.	Diagnosis of nutritional disorders in crops	**2.5 hours**
16.	Plant Growth Analysis	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book(s)		
1.	Lincoln Taiz, Eduardo Zeiger, Ian M. Moller, and Angus Murphy. 2018. Plant Physiology and Development, International Sixth Edition. Sinauer; Oxford University Press; USA.	
Reference Books		
1.	Buchanan. B. B. 2015. Biochemistry and Molecular Biology of Plants. 2nd Edition. Wiley- Blackwell, USA.	
2.	Willey, N. 2016. Environmental Plant Physiology, 1st Edition, Garland Science, Taylor and Francis Group, LLC, UK.	
Mode of Evaluation: Internal assessments and Final assessment test		

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	Date	14-03-2024

Course code	Agricultural Microbiology	L	T	P	C
AGMAG101		1	0	2	2
Pre-requisite	None	Syllabus version			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the fundamental aspects of agricultural microbiology and introduce them to its applications
2. Describing the relationship between microbes and plants
3. Defining the role of microbes in enhancing the productivity of crops by enriching soil fertility

Expected Course Outcome: At the end of the course the student should be able to

1. Discriminate prokaryotic and eukaryotic microbes
2. Delineate the structure and growth of bacteria
3. Utilize microbes as models to study genetics
4. Use microbes in enriching specific plant nutrients
5. Analyze the ubiquitous nature of microbes inhabiting a wide range of ecological habitats
6. Practice bacterial isolation

Module:1	**Microbial World**	**2 hours**
Prokaryotic and eukaryotic microbes.		
Module:2	**Bacteria**	**2 hours**
Bacterial cell structure, chemoautotrophy, photo autotrophy and growth		
Module:3	**Microbial Genetics**	**2 hours**
Genetic recombination - transformation, conjugation and transduction. Plasmids and transposons.		
Module:4	**Biogeochemical Cycles**	**2 hours**
Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles.		
Module:5	**Biological Nitrogen Fixation**	**2 hours**
Symbiotic, associative and asymbiotic microbes involved in nitrogen fixation. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere		
Module:6	**Microbes in Human Health**	**2 hours**
Microbes in human welfare: silage production, biofertilizers, biopesticides and biofuels		
Module:7	**Soil organic matter decomposition**	**2 hours**
Production and biodegradation of agro-waste.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**16**

Text Books

1. Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley and David A. Stahl. Brock Biology of Microorganisms. 2023. Global 14th Edition. Pearson. UK.
2. Gerard J. Tortora, Berdell R. Funke and Christine L. Case. Microbiology: An

	Introduction, 13th Edition. 2019. Pearson Publishers.	
Reference Books		
1.	Bagyaraj D. J. and G. Rangaswami. Agricultural Microbiology 2nd Edition. 2021. PHI Learning Private Limited. India.	
2.	Aneja K.R. Experiments in microbiology, plant pathology, tissue culture and microbial biotechnology. 2022. New Age International Publishers, India.	
3.	Subba Rao, N.S. Agricultural Microbiology. 3d Edition (PB), 2020. Published by Medtec. University Book Store. New Delhi, India.	
4.	Kapoor K.K., M.G. Sequeira, K.S. Yadav P. Tauro. An Introduction to Microbiology 4th Edition, **2023.** New Age International Publishers, New Delhi, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Introduction to microbiology laboratory and its equipment	**2.5 hours**
2.	Microscopy: various types, functional parts, principle, resolving power and numerical aperture. Staining and microscopic examination of microbes.	**2.5 hours**
3.	Methods of sterilization.	**2.5 hours**
4.	Sterilization	**2.5 hours**
5.	Simple Staining Differential Staining and microscopic examination of microbes.	**2.5 hours**
6.	Endospore Staining	**2.5 hours**
7.	Nutritional media and their preparations.	**2.5 hours**
8.	Enumeration of microbial population in soil-bacteria.	**2.5 hours**
9.	Enumeration of microbial population in soil- fungi	**2.5 hours**
10.	Enumeration of microbial population in soil - actinomycetes	**2.5 hours**
11.	Methods of isolation and purification of microbial culture.	**2.5 hours**
12.	Methods of isolation and purification of microbial cultures.	**2.5 hours**
13.	Isolation of *Rhizobium* from legume root nodule	**2.5 hours**
14.	Isolation of *Azotobacter* from soil.	**2.5 hours**
15.	Isolation of *Azospirillum* from roots	**2.5 hours**
16.	Isolation of BGA.	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	**Gerard J. Tortora, Berdell R. Funke and Christine L. Case.** Microbiology: An Introduction, 13th Edition, **2019.** Pearson Publishers.	
Reference Books		
1.	Martin Alexander. Introduction to Soil Microbiology. 2nd Edition, 1991. Krieger publishing company, USA.	
2.	Kapoor K.K., M.G. Sequeira , K.S. Yadav, P. Tauro. An Introduction to Microbiology 4th Edition, 2023. New Age International Publishers, New Delhi, India.	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date**	14-03-2024

Course code	Environmental Studies and Disaster Management	L	T	P	C
ENSAG201		2	0	2	3
Pre-requisite	None	Syllabus version			
		1.0			

Course Objectives: The course is aimed at

1. Demonstrating fundamental principles of nature and problems associated with it.
2. Developing skills of managing natural calamities and/or disasters.
3. Defining current technologies used in environmental management.

Expected Course Outcome: At the end of the course the student should be able to

1. Summarize natural sources and state the need for conserving the resources
2. Understand the functions of ecosystems
3. Comprehend the importance of conserving species on earth
4. Delineate manmade disasters and plan towards sustainable development
5. Demonstrate knowledge acquired in natural disaster management
6. Assess disaster issues and design remedies

Module:1	Natural Resources	7 hours

Definition, scope and importance. Natural Resources: Renewable and non-renewable resources. Natural resources and associated problems - a) Forest resources: Use and over-exploitation, deforestation and case studies; Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources and case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity and case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources and case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module:2	Ecosystems	3 hours

Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers and energy flow in the ecosystem. Ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem and d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Module:3	Biodiversity and its conservation	4 hours

Introduction, definition, genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife and man- wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Module:4	Environmental Pollution and its management	6 hours

Definition, cause, effects and control measures of: a. Air pollution b. Water pollution c.

Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution and g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From unsustainable to sustainable development, urban problems related to energy, water conservation, and rainwater harvesting and watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.		
Module:5	**Environmental Laws**	**3 hours**
Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Program. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.		
Module:6	**Natural and manmade disasters**	**4 hours**
Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves. Climatic change: global warming, sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.		
Module:7	**Disaster Management**	**3 hours**
Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Police and other organizations in disaster response.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours	**32**
Text Books		
1.	Ranjeeta Soni. Environmental Studies and Disaster Management. 2022. New India Publishing Agency, India.	
2.	D.R Khullar and JACS Rao. Environment and Disaster Management. 2021. Tata McGraw Hill Education private limited, India.	
Reference Books		
1.	W. Cunningham, and M. Cumnningham. Principles of Environmental Science: Inquiry and Applications. 4th edition. 2017. McGraw Hill Education.	
2.	Sulphy, M. M. M. M. Safeer. Introduction to Environmental Management, 4th edition. 2017. PHI Learning Private Limited India.	
Mode of Evaluation: Assignment, Mid semester and Final Assessment Test		
Indicative Experiments		
1.	Determination of Alkalinity in the water sample	**2.5 hours**
2.	Determination of Acidity of water sample	**2.5 hours**
3.	Determination of pH of water and soil sample	**2.5 hours**

4.	Determination of EC of the soil samples	**2.5 hours**
5.	Determination of hardness of water samples	**2.5 hours**
6.	Determination of total solids of water sample	**2.5 hours**
7.	Pollution case studies	**2.5 hours**
8.	Field visit to study of simple ecosystems-common plants, insects, and birds	**2.5 hours**
9.	Field visit to study of simple ecosystems -Pond, river	**2.5 hours**
10.	Field Visit to a local area to document environmental assets hill/ mountain	**2.5 hours**
11.	Visit to a local area to document environmental assets forest/ grassland	**2.5 hours**
12.	Field work: Visit to a local area to document environmental assets river	**2.5 hours**
13.	Field visit to a local polluted site -Urban / Rural	**2.5 hours**
14.	Field visit to a local polluted site -Agricultural	**2.5 hours**
15.	Field visit to a local polluted site -Industrial	**2.5 hours**
16.	Field visit to water treatment plant	**2.5 hours**
		2.5 hours
	Total Laboratory Hours	**40**

Text Books	
1	G Lakshmi Swarajya, and P Prabhu Prasadini. Environmental Science: A Practical Manual. 2018. BS Publications, India.
2	S. K. Maiti. Hand Book of Methods in Environmental Studies. 2nd volume. 2016. Oxford Book Company, India.
Reference Books	
1	R.K. Trivedy, V.S. Kulkarni, and S.N. Kaul. A Handbook of Environment Impact Assessment. 2019. Scientific Publishers, India.
2	Dr. R. K. Dave. Disaster Management in India: Challenges and Strategies. 2018. Prowess Publishing, Chennai.

Mode of Evaluation: Internal assessments and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course Code	**Introduction to Forestry**	**L**	**T**	**P**	**C**
FORAG101		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on the concepts of forestry
2. Describing the techniques of natural and artificial regeneration of forests
3. Discussing the methods of forest mensuration and agroforestry.

Expected Course Outcome: At the end of the course the student should be able to

1. Recognize the importance of forestry
2. Explain and appreciate the techniques involved in forest regeneration
3. Describe mensuration techniques to quantify forests data
4. Plan to regenerate a forest

5. Prepare an agroforestry system to support human sustenance.		
Module:1	**Introduction to Forestry**	**2 hours**
Definitions of basic terms related to forestry, objectives of silviculture, forest classification, and salient features of Indian Forest Policies.; Silviculture and its objectives, forest classification		
Module:2	**Regeneration**	**2 hours**
Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.		
Module:3	**Crown classification**	**2 hours**
Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.		
Module:4	**Mensuration**	**2 hours**
Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method.		
Module:5	**Instrumental methods of height measurement**	**2 hours**
Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.		
Module:6	**Introduction to Agroforestry**	**2 hours**
Definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens.		
Module:7	**Cultivation practices**	**2 hours**
Cultivation practices of two important fast growing tree species of the region.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert.		
	Total Lecture hours:	**16**
Text Books		
1.	Sunil D. Patil and Pravin L. Deshmukh. Introduction to forestry - A Textbook. 2020. AkiNik Publications. New Delhi.	
2.	Grebner, D.L. and Bettinger, P. and Siry, J.P. and Boston K. 2021. Introduction to Forestry and Natural Resources 2nd Edition. Academic Press. USA.	
3.	Kershaw, J.A., Ducey, M.J., Beers, T.W. and Husch, B. 2016. Forest Mensuration. Wiley. USA.	
4.	Reddy, S.R and C. Nagamani. Introduction to forestry. 2017. Kalyani Publishers. India.	
Reference Books		
1.	Alka Kushwaha. Introduction to forestry. 1st edition. 2019. Write and Print Publications. India.	
2.	Parthiban, K.T, N. Krishnakumar and M. Karthick. Introduction to forestry & agroforestry. 2018. 1st edition. Scientific publishers, India.	
3.	Nair, P.K.R. and Kumar, M. and Nair, V.D. 2021. An Introduction to Agroforestry. Springer, Germany.	
4.	Montagnini, F. and Ashton, M.S. 2022. Introduction to Forestry. Murphy &	

	Moore Publishing. USA.	
5.	DeVere, L.B. 2021. Introduction to Forestry Science. Thomson Delmar Learning. USA.	
Mode of assessment: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
1.	Identification of tree-species	**2.5 hours**
2.	Identification of tree seeds and seedlings	**2.5 hours**
3.	Nursery lay out and seed sowing techniques	**2.5 hours**
4.	Practicing land preparation, stacking and pitting	**2.5 hours**
5.	Forest plantations and their management	**2.5 hours**
6.	Vegetative propagation techniques- cutting, grafting, budding and layering	**2.5 hours**
7.	After care operations in plantations	**2.5 hours**
8.	Diameter measurements using calipers and tape	**2.5 hours**
9.	Diameter measurements of forked, buttressed, fluted and leaning trees	**2.5 hours**
10.	Height measurement of standing trees by shadow method and single polemethod	**2.5 hours**
11.	Height measurement of standing trees by clinometer and hypsometer	**2.5 hours**
12.	Volume measurement of logs using various formulae	**2.5 hours**
13.	Identification and study of wood products	**2.5 hours**
14.	Identification and study of non- wood forest products	**2.5 hours**
15.	Visit to Agroforestry plantations and research institutes	**2.5 hours**
16.	Visits of nearby forest based industries	**2.5 hours**
	Total Laboratory Hours	**40 hours**
Text Books		
1.	Sunil D. Patil and Pravin L. Deshmukh. Introduction to forestry - A Textbook. 2020. AkiNik Publications. New Delhi.	
2.	Kershaw, J.A. and Ducey, M.J. and Beers, T.W. and Husch, B. 2016. Forest Mensuration. Wiley. USA.	
3.	Reddy, S.R and C. Nagamani. Introduction to forestry. 2017. 1st Edition. Kalyani Publishers. India.	
Reference Books		
1.	Alka Kushwaha. Introduction to forestry. 1st edition. 2019. Write and Print Publications. India.	
2.	Parthiban, K.T, N. Krishnakumar and M. Karthick. Introduction to forestry and agroforestry. 2018. 1st edition. Scientific publishers, India.	
3.	DeVere, L.B. Introduction to Forestry Science. 2021. Thomson Delmar Learning. USA.	
Mode of assessment: Internal Assessment and Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No. 73 **Date**	15-03-2024

Statistics, Computer Application and I.P.R.							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
STAAG201	Statistical Methods	Embedded T & L	1	0	2	2	None
COMAG201	Agri-Informatics	Embedded T & L	1	0	2	2	None
IPRAG301	Intellectual Property Rights	Theory	1	0	0	1	None

Course code	**Statistical Methods**	**L**	**T**	**P**	**C**
STAAG201		**1**	**0**	**2**	**2**
Pre-requisite	None				
	Syllabus version	1.0			

Course Objectives: The course is aimed at

1. Explaining the role of statistics in agriculture
2. Imparting knowledge on collection, analysis and presentation of data
3. Interpreting simple agricultural experiments

Expected Course Outcome: At the end of the course the student should be able to

1. Present and analyze scientific data
2. Solve problems on probability
3. Interpret statistical test outcomes
4. Design and analyze experiments
5. Appreciate the applications of statistical methods in science and engineering
6. Apply relevant statistical analysis to experimental data

Module:1	**Data Presentation**	**1 hour**
Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data		
Module:2	**Data Analysis**	**1 hour**
Measures of Central Tendency & Dispersion. Scatter plots		
Module:3	**Concept of Probability**	**4 hours**
Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial Distribution & Poisson Distributions		
Module:4	**Statistical Measurements**	**2 hours**
Definition of Correlation. Scatter diagram. Karl Pearson's coefficient of correlation. Linear Regression Equations.		
Module:5	**Statistical Tests**	**2 hours**
Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table.		
Module:6	**Analysis of Experimental Designs**	**2 hours**
Design of Experiments – Introduction to Analysis of Variance, Analysis of One Way Classification.		
Module: 7	**Sampling Methods**	**3 hours**
Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.		

Module: 8	**Contemporary Issues**	**1 hour**
Lecture by Research/ Industrial Expert		
	Total Lecture hours:	**16**
Text Books		
1.	Rangaswamy, R. A textbook of Agricultural Statistics. 2016. New Age International (P) Ltd., India.	
Reference Books		
1.	Salkand, N.J. Statistics for People Who (Think They) Hate Statistics. 6th Edition. 2016. Sage Publications. India.	
2.	Gupta, B.N. Statistical Analysis, 2021. SBPD Publications, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1	Construction of frequency distribution tables.	**2.5 hours**
2	Diagrammatic representation and Graphical representation of data.	**2.5 hours**
3	Computation of Measures of Central Tendency and Dispersion for ungrouped data with calculation of Quartiles, Deciles & Percentiles	**2.5 hours**
4	Computation of Measures of Central Tendency and Dispersion for grouped data with calculation of Quartiles, Deciles & Percentiles	**2.5 hours**
5	Computation of moments, skewness and kurtosis for ungrouped and grouped data.	**2.5 hours**
6	Simple problems in Binomial distribution and Poisson distribution.	**2.5 hours**
7	Selection of random sample using simple random sampling method.	**2.5 hours**
8	Two Sample Fisher's t-test; Large sample test – test for single proportion and difference between two proportions	**2.5 hours**
9	Large sample test – test for single mean and difference between two means.	**2.5 hours**
10	Small samples test – t-test for single mean – independent t test for difference between two sample means (equal variances only) – Paired t-test.	**2.5 hours**
11	Chi square test for goodness of fit; Chi-Square test of Independence of Attributes for 2 ×2 contingency table	**2.5 hours**
12	Computation of Karl Pearson's correlation coefficient	**2.5 hours**
13	Correlation & Regression Analysis- fitting of simple linear regression equation y on x	**2.5 hours**
14	One way ANOVA – analysis of experimental data using Completely Randomized Design (CRD)	**2.5 hours**
15	Two way ANOVA – analysis of experimental data using Randomized Block Design (RBD)	**2.5 hours**
16	Analysis of experimental data using Latin Square Design (LSD)	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	Rangaswamy, R. A textbook of Agricultural Statistics. 2016. New Age International (P) Ltd., India.	

Reference Books			
1.	Salkand, N.J. Statistics for People Who (Think They) Hate Statistics. 6th Edition. 2016. Sage Publications. India.		
2.	Gupta, B.N. Statistical Analysis, 2021. SBPD Publications, India.		
Mode of Evaluation: Internal Assessment and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Agri-Informatics**	**L**	**T**	**P**	**C**
COMAG201		**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Describing computers and their usefulness in agriculture
2. Explaining the effectiveness of information and communications technology in agriculture
3. Demonstrating new technologies which generate valuable information in agriculture

Expected Course Outcome: At the end of the course the student should be able to

1. Able to utilize operating systems like MS office and DBMS in agriculture
2. Comprehend programming languages
3. Use the internet for obtaining useful information regarding agriculture
4. Retrieve and generate information using geospatial technology
5. Relate contemporary ideas
6. Compute, create, operate and translate data using operating systems and IT tools

Module:1	**Operating systems and Applications**	**2 hours**
Operating Systems, definition and type. Applications of MSOffice for document creation and Editing. Data presentation, interpretation and graph creation. Statistical analysis, mathematical expressions		
Module:2	**Database management and WWW**	**1 hour**
Database, concepts and types. Uses of DBMS in Agriculture. World Wide Web (WWW): Concepts and components.		
Module:3	**Introduction to computer programming languages**	**4 hours**
Programming languages, concepts and standard input/output operations.		
Module:4	**e-Agriculture**	**2 hours**
Concepts and applications of e-agriculture and use of ICT in Agriculture, Computer-controlled devices (automated systems) for agri-input management, smartphone Apps in Agriculture for farm advises market price and postharvest management.		
Module:5	**Computer Modelling**	**2 hours**
Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops		
Module:6	**Geospatial technology**	**2 hours**
Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in agriculture.		
Module:7	**Expert Systems**	**1 hour**

Agriculture Expert System, Soil Information Systems for supporting farm decisions. Preparation of contingent crop-planning using IT tools.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**16**
Text Books		
1.	Mamta Rana D. Prasad. Agro-informatics. 2017. Bioscientific Publisher, India	
2.	Lovell, C. Agricultural Informatics. 2022. Excelic Press LLC, USA.	
Reference Books		
1.	Choudhury, A. and Biswas, A. and Prateek, M. and Chakrabarti, A. Agricultural Informatics. 2021. Wiley, UK.	
2.	Raju, K. V., V. R. Hegde and Satish A. Hegde. Geospatial Technologies for Agriculture: Case Studies from India. 2018. Springer International Publishing, Switzerland.	
3.	Chandan Kumar Panda, Anil Paswan and Siya Ram Singh Advances in ICT in Agriculture. . 2018. New Delhi Publisher, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Study of computer components, accessories and practice of important DOS commands	**2.5 hours**
2.	Introduction of different operating systems such as windows, Unix/Linux, creating files, folders and file management	**2.5 hours**
3.	Use of MS-WORD for creating, editing a scientific document	**2.5 hours**
4.	Use of MS Powerpoint for presenting a scientific document	**2.5 hours**
5.	MS-EXCEL I: Creating a spreadsheet; use of statistical tools; writing expressions	**2.5 hours**
6.	MS-EXCEL II: Creating graphs and analysis of scientific data	**2.5 hours**
7.	MS-ACCESS I: Creating database; preparing queries and reports	**2.5 hours**
8.	MS-ACCESS II: Demonstration of agri-information system	**2.5 hours**
9.	Introduction to World Wide Web (WWW)	**2.5 hours**
10.	Introduction of programming languages	**2.5 hours**
11.	Hands-on I: Crop Simulation Models (CSM) - Info Crop/ WOFOST	**2.5 hours**
12.	Hands-on II: Crop Simulation Models (CSM) - DSSAT CropSyst	**2.5 hours**
13.	Computation of water requirement of crops using CSM and IT tools	**2.5 hours**
14.	Computation of nutrient requirement of crops using CSM and IT tools	**2.5 hours**
15.	Introduction of geospatial technology for generating valuable information for agriculture	**2.5 hours**
16.	Hands-on: Decision Support System; Preparation of contingent crop planning	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	Mamta Rana D. Prasad. Agro-informatics. 2017. Bioscientific Publisher, India.	
Reference Books		

1.	Choudhury, A. and Biswas, A. and Prateek, M. and Chakrabarti, A. Agricultural Informatics. Wiley, UK.
2.	Chandan Kumar Panda, Anil Paswan and Siya Ram Singh. 2018. Advances in ICT in Agriculture. 2021. New Delhi Publisher, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	**Intellectual Property Rights**	**L**	**T**	**P**	**C**
IPRAG301		**1**	**0**	**0**	**1**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives: The course is aimed at

1. Explaining the evolution of IPR
2. Imparting knowledge on patentability, breeders and farmers rights
3. Describing plant variety and biological diversity protection in India

Expected Course Outcome: At the end of the course the student should be able to

1. Analyze the types of intellectual property and its applications
2. Acquire knowledge on protection of plant varieties and biological diversity
3. Comprehend the legislations covering IPR in India

Module:1	**Introduction**	**2 hours**
Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO		
Module:2	**Treaties**	**1 hours**
Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty		
Module:3	**Types**	**2 hours**
Types of Intellectual Property and legislations covering IPR in India-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits and Trade secrets		
Module:4	**Act and Patentability**	**3 hours**
Patents Act 1970 and Patent system in India. Patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.		
Module:5	**Protection of plant varieties, breeders and farmers rights**	**2 hours**
Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights.		
Module:6	**Traditional knowledge**	**1 hours**
Traditional knowledge-meaning and rights of TK holders.		
Module:7	**Biological Diversity**	**3 hours**
Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA).Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by Industrial Expert		

						Total Lecture hours:	**16**
Text Book							
1.	Kalyan Sarma and Dibyajyoti Talukdar. Textbook Of Intellectual Property In Agriculture, . 2019. Satish Serial Publishing House, India.						
Reference Books							
1.	Ahuja, V.K. Intellectual Property Rights in India. 2015. Lexis Nexis, Vedams eBooks [P] Ltd., India.						
2.	Myneni, S.R. Law Of Farmers & Breeders Rights, 2021. New era law publication, India.						
Mode of assessment: Assignment, Mid-semester and Final assessment test							
Recommended by Board of Studies		28-02-2024					
Approved by Academic Council		No.73	**Date**	14-03-2024			

Animal Production							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
AMPAG201	Livestock and Poultry Management	Embedded T & L	3	0	2	4	None

AMPAG201	**Livestock and Poultry Management**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Pre-requisite	None	**Syllabus version**			
		1.0			

Course Objectives

1. Imparting knowledge on poultry and animal husbandry management
2. Interpreting the usage of techniques involved in rearing livestock and poultry
3. Stating the importance of breeds and designing nutrient-based feeds.

Expected Course Outcome

1. Understand the importance of livestock in human welfare
2. Demonstrate knowledge on housing requirements for poultry and livestock
3. Handle the different life stages of livestock and select best breeds for growing
4. Design and ration feedstuffs for livestock
5. Mange and prevent the occurrence of livestock diseases
6. Rear livestock

Module:1	**Importance of Livestock**	**6 hours**
Livestock resources of India. Contribution of livestock to human community. Role of livestock in building farmers and the national economy. Animal Reproduction.		
Module:2	**Housing management**	**6 hours**
Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine.		
Module:3	**Management of life stages**	**6 hours**

Incubation and hatching. Brooding of chicks. Management of growers and layers.		
Module:4	**Breeds**	**6 hours**
Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.		
Module:5	**Feedstuffs**	**8 hours**
Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions.		
Module:6	**Feed rationing and supplements**	**8 hours**
Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.		
Module:7	**Animal Diseases and its precautions**	**6 hours**
Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.		
Module:8	**Contemporary issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**48**

Text Books	
1.	Arun Kumar Tomar and Sukhvir Singh Tomar. Sustainable Livestock and Poultry Breeding. 2016. Daya Publishing House, India.
2.	Pankaj Kumar Singh, Ravindra Kumar, Sanjay Kumar and Kaushalendra Kumar. Feed Supplements for Livestock and Poultry. 2015. Daya Publishing House, India.
Reference Books	
1.	Banerjee, G.C. A Textbook of Animal Husbandry, 4th edition, 2018. Oxford and IBH Publishing, India.
2.	Colin G. Scanes and Karen D. Christensen. 2019. Poultry Science: Fifth Edition, Waveland Press, USA.

Mode of Evaluation: Assignment, Mid-semester and Final Assessment Test

Indicative Experiments		
1.	External body parts of large and small ruminants.	**2.5 hours**
2.	Handling and restraining of farm animals.	**2.5 hours**
3.	Identification methods of farm animals and poultry.	**2.5 hours**
4.	Perform routine farm operations and maintain the farm records	**2.5 hours**
5.	Judging of large and small ruminants.	**2.5 hours**
6.	Culling of livestock and poultry.	**2.5 hours**
7.	Layout of housing for different types of livestock.	**2.5 hours**
8.	Computation of rations and formulation of feed.	**2.5 hours**
9.	Clean milk production and milking methods.	**2.5 hours**
10.	Hatchery operations and hatching equipment.	**2.5 hours**
11.	Management of chicks, growers and layers.	**2.5 hours**
12.	Debeaking, dusting and vaccination of poultry.	**2.5 hours**
13.	Economics of large and small ruminant farming.	**2.5 hours**
14.	Economics of swine and poultry production.	**2.5 hours**
15.	Value addition to livestock products.	**2.5 hours**
16.	Marketing of livestock products.	**2.5 hours**

			Total Laboratory Hours:	**40**
Text Books				
1.	Arun Kumar Tomar and Sukhvir Singh Tomar. Sustainable Livestock and Poultry Breeding. 2016. Daya Publishing House, India.			
2.	Pankaj Kumar Singh, Ravindra Kumar, Sanjay Kumar and Kaushalendra Kumar. Feed Supplements for Livestock and Poultry. 2015. Daya Publishing House, India.			
Reference Books				
1.	Banerjee, G.C. A Textbook of Animal Husbandry, 4th edition, 2018. Oxford and IBH Publishing, India.			
2.	Colin G. Scanes and Karen D. Christensen. 2019. Poultry Science: Fifth Edition, Waveland Press, USA.			
Mode of Evaluation: Internal Assessment and Final Assessment Test				
Recommended by Board of Studies		28-02-2024		
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Language							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
ENGAG101	Comprehension and Communication Skills in English	Embedded T & L	1	0	2	2	None

Course code	**Comprehension and Communication Skills in English**		**L**	**T**	**P**	**C**
ENGAG101			**1**	**0**	**2**	**2**
Pre-requisite	None	**Syllabus version**				
		1.0				
Course Objectives: The course is aimed at						
1. Enhancing communication skills in English 2. Developing writing skills and improving vocabulary 3. Imparting knowledge on developing presentation skills						
Expected Course Outcome: At the end of the course the student should be able to						
1. Analyze grammatical errors 2. Identify correct pronunciation 3. Express writing skills 4. Comprehend course materials and improve oral communication skills 5. Demonstrate presentation skills 6. Illustrate communication skills						
Module:1	**Functional grammar**	**3 hours**				
Articles, Prepositions, Verbs, Subject verb Agreement; Transformation and Synthesis.						
Module:2	**Vocabulary**	**2 hours**				

Antonym, Synonym, Homophones, Homonyms, Words often confused		
Module:3	**Case Studies**	**2 hours**
TOEFL and Competitive Exam Papers		
Module:4	**Facets of technical written communication**	**3 hours**
The Style: Importance of professional writing; Written Skills - Paragraph writing, Synopsis writing, Precise writing, Report writing and Proposal writing		
Module:5	**Written communication**	**2 hours**
A Dilemma - A layman looks at science, Raymond B. Fosdick; Preparation of Curriculum Vitae and Job applications.		
Module:6	**Principles of oral communication**	**2 hours**
Reading Comprehension; Direct and Indirect Narration; You and Your English - Spoken English and broken English		
Module:7	**Oral communication**	**1 hours**
G.B. Shaw; War minus Shooting - The Sporting Spirit; Interviews: kinds, importance and process.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by an Expert		
	Total Lecture hours:	**16**

Text Book	
1.	Raymond Murphy. Essential grammar in use. 3rd edition. 2015. Cambridge University Press. UK.
Reference Books	
1.	Karin Knisely. A Student Handbook for Writing in Biology. 5th Edition. 2017. W. H. Freeman, UK.
2.	Darla-Jean Weatherford. Technical Writing in Engineering Professions. 2016. Tulsa, Oklahoma :PennWell Corp., USA.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Listening Comprehension: Listening to short talks	**2.5 hours**
2.	Listening to lectures & speeches (scientific, commercial and general in nature).	**2.5 hours**
3.	Oral Communication: Phonetics, stress and intonation	**2.5 hours**
4.	Conversation practice	**2.5 hours**
5.	Conversation: rate of speech, clarity of voice	**2.5 hours**
6.	Conversation practice: Speaking and listening with politeness.	**2.5 hours**
7.	Reading skills: Reading dialogues	**2.5 hours**
8.	Rapid reading	**2.5 hours**
9.	Reading skills: Intensive Reading (Skimming & Scanning)	**2.5 hours**
10.	Improving reading skill	**2.5 hours**
11.	Mock Interviews: Introduction, practice and testing.	**2.5 hours**
12.	Introduction to leadership	**2.5 hours**
13.	Leadership Skills: Testing initiative, intellectual ability and team spirit	
14.	Introduction to group discussions	**2.5 hours**
15.	Enrichment of vocabulary based on TOEFL, IELTS, BEC - an	**2.5 hours**

	introduction and practice.	
16.	Enrichment of vocabulary based on other competitive examinations – an introduction and practice	**2.5 hours**
	Total Laboratory Hours	**40**

Text Book	
1.	Kenneth Anderson, Joan Maclean, Tony Lynch. 2013. Study Speaking. 2nd Edition. Cambridge University Press, UK.
Reference Books	
1.	Karin Knisely. A Student Handbook for Writing in Biology. 5th Edition. 2017. W. H. Freeman, UK.
2.	Darla-Jean Weatherford. Technical Writing in Engineering Professions. 2016. Tulsa, Oklahoma :PennWell Corp., USA.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
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Programme Electives (Credits to be earned: 9)							
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**C**	**Prerequisite**
GPBAG204	Micro propagation Technologies	Embedded T & L	1	0	4	3	GPBAG202
HORAG205	Landscaping	Embedded T & L	2	0	2	3	HORAG101
AGRAG206	Agrochemicals	Embedded T & L	2	0	2	3	AGRAG101
AGRAG207	Weed Management	Embedded T & L	2	0	2	3	AGRAG101
AGMAG302	Biopesticides and Biofertilizers	Embedded T & L	2	0	2	3	AGMAG101
HORAG306	Protected Cultivation	Embedded T & L	2	0	2	3	HORAG101
AECAG304	Agribusiness Management	Embedded T & L	2	0	2	3	AECAG203
AEXAG305	Agricultural Journalism	Embedded T & L	2	0	2	3	AEXAG102
HORAG308	Hi-tech. Horticulture	Embedded T & L	2	0	2	3	HORAG101
GPBAG307	Commercial Plant Breeding	Embedded T & L	1	0	4	3	GPBAG202
COMAG302	System Simulation and Agro-advisory	Embedded T & L	2	0	2	3	AGRAG205
FSNAG302	Food Safety and Standards	Embedded T & L	2	0	2	3	BICAG101

Course code	**Micro propagation Technologies**	**L**	**T**	**P**	**C**
GPBAG204		**1**	**0**	**4**	**3**

Pre-requisite		Syllabus version
GPBAG202	Fundamentals of Plant Breeding	1.0

Course Objectives: The course is aimed at

1. Describing the importance of plant tissue culture
2. Imparting knowledge on the commercial importance of *in vitro* propagation
3. Introducing the role of tissue culture in plant breeding

Expected Course Outcome: At the end of the course the student should be able to

1. Understand how *in vitro* culture originated and appreciate its applications
2. Comprehend the various types of plant tissue culture and its importance
3. Demonstrate mass multiplication of micropropagules
4. Apply tissue culture techniques in crop improvement
5. Examine the demands of the plant tissue culture industry
6. Practice plant tissue culture techniques and become an entrepreneur

Module:1	**Introduction**	**2 hours**
History - Origin and chronology of important developments in plant tissue culture, advantages and limitations of plant tissue culture		
Module:2	**Nutrients**	**2 hours**
Source and role of macro nutrients, micro nutrients, plant growth regulators, carbon source, vitamins, supplements and gelling agents		
Module:3	**Types of cultures and its importance**	**3 hours**
Totipotency and plasticity; Explant; Culture types: Seed, embryo, callus, protoplast, leaf, nodal, root, shoot, embryo and microspore cultures; Cell and cell suspension cultures and production of secondary metabolites		
Module:4	**Micropropagation**	**2 hours**
Stages of micropropagation; Axillary bud proliferation and culture, Shoot tip and meristem culture;		
Module:5	**Organogenesis**	**2 hours**
Direct and indirect organogenesis; Somatic embryogenesis; Regeneration and Hardening		
Module:6	**Applications**	**2 hours**
Germplasm conservation and cryopreservation; Synthetic seed; Shortening of breeding cycles		
Module:7	**Scope in crop improvement**	**2 hours**
Somaclonal variation, Haploid and polyploid plant development; Somatic hybridization; *In vitro* pollination, embryo rescue and wide hybridization; Screening for stress; Propagation of transformed explant/callus		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by industrial expert		
	Total Lecture hours:	**16**

Text Book

1.	Razdan, M.K. Introduction to Plant Tissue Culture. 2019. 3rd Edition, Oxford and IBH Publishing, India.

Reference Books

1.	Gamborg, O.L. and G.C. Phillips. Plant cell, tissue and organ culture: fundamental methods. . 2019. Springer, USA.
2.	Pullaiah, T., M.V. Subba Rao and E. Sreedevi. Plant Tissue Culture: Theory & Practicals. 2022. 2nd edition, Scientific Publishers, India.

Mode of assessment: Assignment, Mid-semester and Final assessment test

Indicative Experiments		
1.	Identification and use of equipment in tissue culture laboratory	**5 hours**
2.	Design and structure of a plant tissue culture laboratory	**5 hours**
3.	Study on the design and structure of a greenhouse	**5 hours**
4.	Nutrition media composition - Hoagland solution, Murashige and Skoog's, Gamborg's, Nitsch's and White's media for varied cultures	**5 hours**
5.	Sterilization techniques for media, containers and small instruments	**5 hours**
6.	Sterilization techniques for explants	**5 hours**
7.	Preparation of stocks and working solution	**5 hours**
8.	Preparation of working medium	**5 hours**
9.	Culturing of explants: Seeds and shoot tip and single node	**5 hours**
10.	Sub-culturing	**5 hours**
11.	Friable Callus induction	**5 hours**
12.	Induction of somatic embryos	**5 hours**
13.	Cell suspension culture	**5 hours**
14.	Micropropagation	**5 hours**
15.	Regeneration of whole plants from different explants	**5 hours**
16.	Primary and secondary hardening procedures	**5 hours**
	Total Laboratory Hours	**80**

Text Book	
1.	Razdan, M.K. 2019. Introduction to Plant Tissue Culture. 3rd Edition, Oxford and IBH Publishing, India.
Reference Books	
1.	Gamborg, O.L. and G.C. Phillips. Plant cell, tissue and organ culture: fundamental methods. . 2019. Springer, USA.
2.	Pullaiah, T., M.V. Subba Rao and E. Sreedevi. Plant Tissue Culture: Theory & Practicals. 2022. 2nd edition, Scientific Publishers, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course Code	**Landscaping**	**L**	**T**	**P**	**C**
HORAG205		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamental of Horticulture	1.0			

Course Objectives: The course is aimed at

1. Demonstrating the scope of landscaping
2. Imparting knowledge on propagation and maintenance of landscaping plants
3. Demonstrating designing and maintenance of landscapes

Course Outcomes: At the end of the course students should be able to

1. Understand the basic principles and importance of landscaping
2. Select and propagate plants suitable for landscaping
3. Propagate and manage pot plants
4. Contribute towards improvement of bio-aesthetic landscaping architecture in urban and rural areas
5. Manage bonsai and lawns
6. Develop and design sustainable landscapes

Module:1	**Importance and Scope of landscaping**	**2 hours**
Importance and scope of landscaping, Principles of landscaping		
Module:2	**Garden Styles and Types**	**6 hours**
Garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features and gardens for special purposes.		
Module:3	**Ornamental Tree and Shrubs**	**4 hours**
Trees, shrubs and herbaceous perennials : selection, propagation, planting schemes and canopy management		
Module:4	**Climbers, Cacti, Succulents, Annuals and others Garden Plants**	**6 hours**
Climber and creepers: importance, selection, propagation and planting; Annuals: selection, propagation and planting scheme; Other garden plants: palms, ferns, grasses and cacti succulents.		
Module:5	**Potted Plants**	**2 hours**
Pot plants: selection, arrangement and management.		
Module:6	**Bio-aesthetic Planning**	**6 hours**
Bio-aesthetic planning: definition, need and planning. Landscaping of urban and rural areas. Peri-urban landscaping. Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries and institutions.		
Module:7	**Bonsai, Lawn and CAD**	**4 hours**
Bonsai: principles and management. Lawn: establishment and maintenance. Computer aided design application.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**

Text Book	
1.	Singh, A.K. and Sisodia, A. Textbook of Floriculture and Landscaping, 2020. New India Publishing Agency, India.
Reference Books	
1.	Bose, T. K., Singh, L. J., Sadhu, M.K. and Maity. T.K. Ornamental Plants and Garden Design in Tropics and Subtropics (2 Vols.). 2015. Astral International Ltd., India.
2.	Ingels, J.E., Smith, A.S. Landscaping principles and practices. 8th edition, 2018. Cengage Learning, USA.

Mode of Evaluation: Assignments, Mid-Term, and Final Assessment Test

Indicative Experiments		
1.	Identification of Ornamental trees, shrubs, and climbers	**2.5 hours**
2.	Identification of annuals, succulent, cacti, palm, fern and grasses	**2.5 hours**
3.	Identification of pot plants	**2.5 hours**
4.	Propagation of trees, shrubs, and annuls	**2.5 hours**
5.	Care and maintenance of plants, potting, and repotting	**2.5 hours**
6.	Identification of tools and implements used in landscape designs	**2.5 hours**
7.	Training and pruning of plants for special effects	**2.5 hours**
8.	Lawn establishment and maintenance	**2.5 hours**
9.	Layout of formal garden	**2.5 hours**

10.	Layout of informal garden	**2.5 hours**
11.	Special types of garden-sunken garden	**2.5 hours**
12.	Special types of garden-terrace garden	**2.5 hours**
13.	Special types of garden-Rock garden	**2.5 hours**
14.	Design of conservatory lathe house	**2.5 hours**
15.	Use of computer software	**2.5 hours**
16.	Visit to important gardens/parks/institutes	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Book	
1.	Ingels, J.E., Smith, A.S. Landscaping principles and practices. 8th edition, 2018. Cengage Learning, USA.
Reference Books	
1.	Randhawa, G.S. and Mukhopadhyay, A. 2022. Floriculture in India. Allied Publishers private limited, India.
2.	Piet Oudolf and Henk Gerritsen. 2019. Planting the Natural Garden. Timber Press, USA.

Mode of assessment: Internal assessments and Final assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	14-03-2024

Course Code	**Agrochemicals**	**L**	**T**	**P**	**C**
AGRAG206		**2**	**0**	**2**	**3**
Pre-requisite	Fundamentals of Agronomy	**Syllabus version**			
AGRAG101		1.0			

Course Objectives: The course is aimed at

1. Understanding the role of agrochemicals in agriculture and its effect on environment
2. Imparting knowledge on herbicides, fungicides, insecticides, fertilizers and its applications
3. Emphasizing the use of right dose of agrochemicals for sustainable agriculture

Expected Course Outcome: At the end of the course the student should be able to

1. Infer the importance of agrochemicals for sustainable agriculture
2. Acquire knowledge on herbicides and fungicides
3. Classify and know the role of insecticides
4. Analyze fertilizers application related to crop growth
5. Acquire knowledge on mixed and complex fertilizers
6. Recommend dosage of agrochemicals for farms

Module:1	**Introduction to agrochemicals**	**3 hours**

Type and role of agrochemicals in agriculture. Effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture. Management of agrochemicals for sustainable agriculture.

Module:2	**Herbicides**	**3 hours**

Herbicides-major classes, properties and important herbicides. Fate of herbicides.

Module:3	**Fungicides**	**4 hours**

Classification of fungicides. Inorganic fungicides: characteristics, preparation and use of sulfur and copper. Mode of action of Bordeaux mixture and copper oxychloride.

Organic fungicides, mode of action of Dithiocarbamates, characteristics, preparation and use of Zineb and Maneb. Systemic fungicides, characteristics and use of Benomyl, Carboxin, Oxycarboxin, Metalaxyl and Carbendazim,		
Module:4	**Insecticides**	**7 hours**
Introduction and classification of insecticides, inorganic and organic insecticides. Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids, Neonicotinoids and Biorationals. Insecticide Act and rules. Insecticides banned, withdrawn and restricted for use. Fate of insecticides in soil and plant. IGRs, biopesticides, reduced risk insecticides, botanicals, plant and animal systemic insecticides, their characteristics and uses. Plant bio-pesticides for ecological agriculture. Bio-insect repellent.		
Module:5	**Fertilizers**	**6 hours**
Fertilizers and their importance. Nitrogenous fertilizers: feedstocks and manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride and urea. Slow-release N fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate, preparation of bone meal and basic slag. Potassic fertilizers: natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.		
Module:6	**Mixed and complex fertilizers**	**5 hours**
Mixed and complex fertilizers: sources and compatibility, preparation of major, secondary and micronutrient mixtures. Complex fertilizers: manufacturing of ammoniumphosphates, nitrophosphates and NPK complexes.		
Module:7	**Fertilizer control order**	**2 hours**
Fertilizer control order. Fertilizer logistics and marketing.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**
Text Books		
1.	Ranjan Kumar Basak. Fertilizers: A Text Book. 2016. Kalyani publishers, India.	
2.	Himadri Panda. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details. 2022. 2nd Edition. Kalyani publishers, India.	
Reference Books		
1.	Pardeep Singh, Suruchi Singh, Mika Sillanpaa. Pesticides in the Natural Environment - Sources, Health Risks, and Remediation. 1st Edition. 2022. Elsevier, USA.	
2.	Singh, A. Basics of Agrochemical Formulations. 2022. Brillion Publishing, India.	
Mode of assessment: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
17.	Sampling of fertilizers and pesticides	**2.5 hours**
18.	Pesticides application technology to study about various pesticides appliances	**2.5 hours**
19.	Quick tests for identification of common fertilizers	**2.5 hours**
20.	Identification of anions in fertilizer	**2.5 hours**
21.	Identification of cations in fertilizer	**2.5 hours**
22.	Calculation of doses of insecticides to be used.	**2.5 hours**
23.	To study and identify various formulations of insecticide available in the market	**2.5 hours**

24.	Estimation of nitrogen in Urea	**2.5 hours**
25.	Estimation of water soluble P_2O_5 in single super phosphate	**2.5 hours**
26.	Estimation of citrate soluble P_2O_5 in single super phosphate	**2.5 hours**
27.	Estimation of potassium in Muraite of Potash by flame photometer	**2.5 hours**
28.	Estimation of potassium in Sulphate of Potash by flame photometer	**2.5 hours**
29.	Determination of copper content in copper oxychloride	**2.5 hours**
30.	Determination of sulphur content in sulphur fungicide	**2.5 hours**
31.	Determination of thiram content	**2.5 hours**
32.	Determination of ziram content	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Books	
1.	Ranjan Kumar Basak. Fertilizers: A Text Book. 2016. 1st Edition. Kalyani publishers, India.
2.	Himadri Panda. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details. 2022. 2nd Edition. Kalyani publishers, India.
Reference Books	
1.	Pardeep Singh, Suruchi Singh, Mika Sillanpaa. Pesticides in the Natural Environment - Sources, Health Risks, and Remediation. 1st Edition. 2022. Elsevier, USA.
2.	Singh, A. Basics of Agrochemical Formulations. 2022. Brillion Publishing, India.

Mode of assessment: Internal Assessments and Final Assessment Test			
Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	14-03-2024

Course Code	**Weed Management**	**L**	**T**	**P**	**C**
AGRAG207		**2**	**0**	**2**	**3**
Pre-requisite	Fundamentals of Agronomy	**Syllabus version**			
AGRAG101		1.0			

Course Objectives: The course is aimed at

1. Identifying major weeds in different agro-ecosystems
2. Imparting knowledge on different types weeds and their biology
3. Emphasizing the critical periods of crop-weed competition and state the importance of herbicides in weed control

Expected Course Outcome: At the end of the course the student should be able to

1. Identify different weed species, their characteristics and biology.
2. Expalin the menace caused by weeds.
3. Understand the crop weed competition, allelopathy and their classifications.
4. Gain knowledge of herbicides, formulations and their mode actions.
5. Adopt appropriate weed control methods and IWM.

Module:1	**Weed Introduction**	**3 hours**
Introduction to weeds, characteristics, harmful and beneficial effects on ecosystem		
Module:2	**Weed Biology**	**4 hours**

Classification of weeds and biology of terrestrial, parasitic and aquatic weeds		
Module:3	**Weeds Propagation and Competition**	**3 hours**
Weeds reproduction, dissemination, crop weed competitions; Allelopathy and its application for weed management		
Module:4	**Herbicides**	**4 hours**
Herbicides classifications, methods of application, formulations, adjuvants, surfactants and safeners		
Module:5	**Herbicide Application**	**6 hours**
Methods of herbicide application, compatibility with agro-chemicals, utility of herbicide mixtures, mode and mechanism of action of herbicides and selectivity		
Module:6	**Methods of Weed Management**	**5 hours**
Methods of weed management – Cultural method, biological method, Mechanical method and Chemical method. Integrated Weed Management (IWM)		
Module:7	**Herbicide Resistance**	**5 hours**
Herbicide resistance, mechanisms, herbicide resistance testing and management of herbicide resistance weeds. Weed shift, persistence and degradation of herbicides in plants and soils;		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Industrial Expert		
	Total Lecture hours:	**32**

Text Books		
1.	Panda S. C. Principles and Practices of Weed Management. 2015. Agrobios, India.	
2.	Reddy S. R. Weed Management. 2020. Kalyani Publishers, India.	
3.	Gupta O.P. Weed Management Principles and Practices 3rd edition. 2019. Agrobios, India.	
Reference Books		
1.	Das T. K. Weed Science: Basics and Applications. 2016. Jain Brothers, India.	
2.	Maliwal, P.L and S.L. Mundra. Weed Management. 1st Edition. 2019. Agrotech Publishing Academy, India.	
Mode of assessment: Assignment, Mid-semester and Final Assessment Test		
Indicative Experiments		
1.	Weed identification, classification and characteristics of weeds	**2.5 hours**
2.	Acquiring skill in weed preservation techniques	**2.5 hours**
3.	Study of weed biology of problematic weeds	**2.5 hours**
4.	Study of weed biology of parasitic weeds	**2.5 hours**
5.	Study of weed biology of aquatic weeds	**2.5 hours**
6.	Identification of herbicides	**2.5 hours**
7.	Study of herbicide formulations	**2.5 hours**
8.	Study of herbicide mixtures	**2.5 hours**
9.	Acquiring skill in methods of herbicide application	**2.5 hours**
10.	Calibration of spray equipment	**2.5 hours**
11.	Calculation of herbicide dose	**2.5 hours**
12.	Weed control efficiency and weed index	**2.5 hours**
13.	Study of weed shift in long term experiments	**2.5 hours**
14.	Economic analysis and efficiency of different weed management	**2.5 hours**
15.	Visit to problem and parasitic weed infestation areas/herbicide industries	**2.5 hours**
16.	Visit to Weed Science Research Institute/herbicide testing	**2.5 hours**

	laboratory	
	Total Laboratory Hours:	**40**
Text Books		
1.	Maliwal P L. Practical manual on weed management. 2020. Agri Biovet, India.	
2.	Abhijit Sarma. Numerical Agronomy, 5th edition. 2020. Kalyani publishers, India.	
Reference Books		
1.	T. K. Das. Weed Science: Basics and Applications. 2016. Kalyani publishers.India.	
2.	Maliwal, P.L and S.L. Mundra. Weed Management. 1st Edition. 2019. Agrotech Publishing Academy, India.	
Mode of assessment: Internal assessments and Final Assessment Test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No. 73 **Date**	15-03-2024

Course code	**Biopesticides and Biofertilizers**	**L**	**T**	**P**	**C**
AGMAG302		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
AGMAG101	Agricultural Microbiology	1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on mass production of biopesticides and biofertilizers
2. Describing the mode of action of biopesticides and biofertilizers
3. Demonstrating the practical applications of biopesticides and biofertilizers

Expected Course Outcome: At the end of the course the student should be able to

1. Acquire knowledge on scope and importance of biopesticides
2. Demonstrate mass production and application technology of biopesticides
3. Comprehend the types of biofertilizers and their characteristics features
4. Explain the mechanism and mass production of biofertilizers
5. Demonstrate the different methods of biofertilizer application
6. Mass produce biopesticides and biofertilizers

Module:1	**Scope of Bio pesticides**	**4 hours**

History and concept of biopesticides. Importance, scope and potential of biopesticides. Definitions, concepts and classification of biopesticides - pathogen, botanical pesticides, and biorationals.

Module:2	**Botanicals**	**2 hours**

Botanicals and their uses as bio pesticides

Module:3	**Mass production and application of biopesticides**	**5 hours**

Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

Module:4	**Characteristics of biofertilizers**	**5 hours**

Biofertilizers - introduction, status and scope. Structure and characteristic features of bacterial biofertilizers - *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*. Cyanobacterial biofertilizers- *Anabaena*, *Nostoc* and *Hapalosiphon.* Fungal biofertilizers - AM mycorrhiza and ectomycorhiza.

Module:5	**N fixation, P mobilization and K solubilisation**	**4 hours**

Nitrogen fixation - free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization. K solubilisation.		
Module:6	**Strain selection and production**	**5 hours**
Production technology: strain selection, sterilization, growth, fermentation, mass production of carrier based and liquid biofertiizers. FCO specifications and quality control of biofertilizers.		
Module:7	**Application and quality control of biofertilizers**	**5 hours**
Application technology for seeds, seedlings, tubers and sets. Biofertilizers - storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by Research/Industrial Expert		
	Total Lecture hours:	**32**

Text Books	
1.	Kaushik B.D, Deepak Kumar and Md. Shamim Biofertilizers and Biopesticides in sustainable agriculture, 2021. Apple Academic Press, USA.
2.	Giri, B. Prasad, R., Wu, Q.S. and A. Varma. Biofertilizers for Sustainable Agriculture and Environment. 2019. Springer International Publishing, Germany.
Reference Books	
1.	Kannaiyan, S, K. Govindarajan and K. Kumar. Biofertilizers Technology, 2010. Scientific Publishers, India.
2.	Himadri Panda. The Complete Technology Book on Biofertilizer and Organic Farming.3^{d} Edition, 2022. NPCS Publishers, India.
Mode of assessment: Assignment, Mid-semester and Final assessment test	
Indicative Experiments	

1.	Isolation and purification of *Trichoderma, Pseudomonas,*	**2.5 hours**
2.	Isolation and purification of *Bacillus, Metarhizium* sp.	**2.5 hours**
3.	Isolation and purification of *Beauveria*	**2.5 hours**
4.	Mass production of *Trichoderma, Pseudomonas, Bacillus, Beauveria* and *Metarhizium*, sp.	**2.5 hours**
5.	Identification of important botanicals	**2.5 hours**
6.	Visit to biopesticide laboratory	**2.5 hours**
7.	Field visit to explore naturally infected cadavers and identification of entomopathogenic entities in field condition.	**2.5 hours**
8.	Quality control of biopesticides.	**2.5 hours**
9.	Isolation and purification of Azospirllum,	**2.5 hours**
10.	Isolation and purification of Rhizobium,	**2.5 hours**
11.	Isolation and purification of Azotobacter,	**2.5 hours**
12.	Isolation and purification of P-solubilizers and cyanobacteria.	**2.5 hours**
13.	Isolation and purification of cyanobacteria.	**2.5 hours**
14.	Mass multiplication and inoculum production of biofertilizers.	**2.5 hours**
15.	Isolation of Arbuscular Mycorrhizal fungi – wet sieving method and sucrose gradient method	**2.5 hours**
16.	Mass production of AM inoculants.	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		

1.	Kaushik B.D, Deepak Kumar and Md. Shamim Biofertilizers and Biopesticides in sustainable agriculture, 2021. Apple Academic Press, USA.
Reference Books	
1.	Kannaiyan, S, K. Govindarajan and K. Kumar. Biofertilizers Technology, 2010. Scientific Publishers, India.
2.	Himadri Panda. The Complete Technology Book on Biofertilizer and Organic Farming.3d Edition, 2022. NPCS Publishers, India.
Mode of Evaluation: Internal assessments and Final assessment test	
Recommended by Board of Studies	28-02-2024
Approved by Academic Council	No.73 **Date** 14-03-2024

Course Code	**Course Title**	**L**	**T**	**P**	**C**
HORAG306	**Protected Cultivation**	**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamental of Horticulture	1.0			

Course Objectives: The course is aimed at

1. Describing the importance of protected cultivation
2. Imparting knowledge on designing and managing greenhouses
3. Providing knowledge on protected cultivation of horticultural and economically important crops

Course Outcomes: At the end of the course students should be able to

1. Understand the importance of protected cultivation
2. Design and manage greenhouses for protected cultivation
3. Manage soil, nutrients and irrigation systems under protected cultivation
4. Gain knowledge on cultivation and propagation of plants in a greenhouse
5. Plan, manage and propagate crops under protected cultivation for commercial purposes

Module:1	**World and Indian Scenario of Protected Cultivation**	**2 hours**

Importance and scope of protected cultivation, present status and future scope of protected cultivation in India and throughout the world.

Module:2	**Greenhouse Design**	**2 hours**

Types of protected structure based on site and climate. Cladding material involved in greenhouse/poly house. Greenhouse design and components.

Module:3	**Environmental Factors**	**4 hours**

Environment control for crop regulation, heating and cooling system, ventilation, artificial lights and automation. Technological advancement for protected cultivation - hydroponic, and aeroponic

Module:4	**Greenhouse Management**	**6 hours**

Soil preparation and management. Substrate management. Types of benches and containers. Irrigation and fertigation management.

Module:5	**Greenhouse cultivation of Ornamental plants**	**6 hours**

Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops - Rose, Carnation, Chrysanthemum, Gerbera, Orchid, Anthurium, Lilium, Tulip, Potted plants

Module:6	**Greenhouse cultivation of Vegetables, Fruits, Medicinals and Aromatics**	**6 hours**

Green house cultivation of Tomato, Bell pepper, Cucumber, Strawberry, and

economically important medicinal and aromatic plants. Off season production of flowers and vegetables		
Module:7	**Plant Protection**	**4 hours**
Insect pest and disease management strategies in protected cultivation		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**

Text Books	
1	Sabir, N., Singh, A. K. and Hasan, M. Greenhouse Agriculture: Production and Protection: A Text and Farmer-Friendly Book on Protected Cultivation. (Vol. 1). 2021. Pentimer Publications. India.
2	Singh, B., Singh, B., Sabir, N. and Hasan, M. Advances in protected cultivation. 2015. New India Publishing Agency, India.
Reference Books	
1.	Criley,R.A., Loges,V., Marcsik, D.M., Morgan,E. and Serek,M. Ornamental Horticulture in Global Greenhouse, 2019. ISHS, Astral, India.
2.	Baptista,F.J.,Meneses, J.F. and Silva,L.L. New Technologies and Management for Greenhouses Vol. I,II, ISHS, 2019. Biogreen publisher, India.
3.	Reddy P. Parvatha. Sustainable crop protection under protected cultivation, 2016. Springer, Singapore.

Mode of Evaluation: Assignment, Mid-term and Final assessment test

Indicative Experiments		
1.	Site selection and orientation of protected structures	**2.5 hours**
2.	Different types of protected structures and various components	**2.5 hours**
3.	Different types of cladding materials used in protected structures	**2.5 hours**
4.	Different type of growing media and their preparations	**2.5 hours**
5.	Raising of seedlings and saplings under protected structures	**2.5 hours**
6.	Use of portrays in quality planting material production	**2.5 hours**
7.	Bed preparation and planting of seedlings under protected structures	**2.5 hours**
8.	Planting of crop for production	**2.5 hours**
9.	Intercultural operations in protected structures	**2.5 hours**
10.	Measurement of EC of soil and irrigation water for crop production under protected structures	**2.5 hours**
11.	Measurement of pH of soil and irrigation water for crop production under protected structures	**2.5 hours**
12.	Regulation of drip irrigation, fogging and misting under protected structures	**2.5 hours**
13.	Regulation of fertigation under protected structures	**2.5 hours**
14.	Regulation of light, temperature, humidity in greenhouse for cultivation of different crop	**2.5 hours**
15.	Hydroponics and NFT for growing crops in greenhouse	**2.5 hours**
16.	Plant protection practices in protected cultivation.	**2.5 hours**
	Total Laboratory Hours:	**40**

Text Books

1.	Kumar, S., Kumar, A. and Kumar, S. Protected Cultivation and Secondary Agriculture, 2020. LAP Lambert Academic Publishing, Germany.
2.	Deogirikar, A. A Text Book on Protected Cultivation and Secondary Agriculture. 2019. Rajlaxmi Prakashan, India.
Reference Books	
1.	Kumar, B. A., Ramesh E., Sindhu, V. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops, 2020. Jain brothers, India.
2.	Patil, B.H. Greenhouse Technology And Secondary Agriculture, 2017. Dominant publishers, India.
Mode of assessment: Internal assessments and Final assessment	

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No. 73	**Date**	14-03-2024

Course code	**Agribusiness Management**	**L**	**T**	**P**	**C**
AECAG304		**2**	**0**	**2**	**3**
Pre-requisite	Agricultural Marketing Trade & Prices	**Syllabus version**			
AECAG203		1.0			

Course Objectives: The course is aimed at

1. Explaining agribusiness and transformation of agriculture into agribusiness
2. Demonstrating procedures of setting up and management of agro-based industries
3. Outlining the various activities and linkages in agri-value chain management

Expected Course Outcome: At the end of the course the student should be able to

1. Acquire knowledge on transforming agriculture into agribusiness.
2. Comprehend the procedures of setting up of agro-based industries.
3. Analyze activities and linkages in agri-value chain and the business environment
4. Assess the capital, financial and marketing management of agribusiness.
5. Develop skills in project formulation, appraisal and evaluation
6. Do agribusiness

Module:1	**Agribusiness**	**4 hours**

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy.

Module:2	**Agro-based industries**	**4 hours**

Distinctive features, importance and needs of agro-based industries. Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro-based industries. Constraints in establishing agro-based industries.

Module:3	**Agri-Value chain**	**4 hours**

Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles and activities and organization culture.

Module:4	**Business plan**	**4 hours**

Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, strategies, polices procedures, rules, programs and budget. Components of a business plan. Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications and control.

Module:5	**Capital, and finance Management**	**6 hours**

Capital management and management of agribusiness. Financial statements and their importance.		
Module 6:	**Marketing management**	**4 hours**
Marketing management: segmentation, targeting and positioning. Marketing mix and marketing strategies. Consumer behaviour analysis. Product Life Cycle (PLC). Sales and distribution management. Pricing policy and various pricing methods		
Module:7	**Project appraisal and evaluation**	**4 hours**
Project management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project appraisal and evaluation techniques.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**
Text Books		
1.	Subba Reddy, S and P. Raghu Ram. Agricultural Finance and Management. 2018. Oxford & IBH Publishing Company Private Ltd., India.	
2.	Freddie L. Barnard, John C. Foltz, and Elizabeth A. Yeager. 2016. Agribusiness Management. 5th edition, Routledge. UK.	
Reference Books		
1.	Chopra S, Meindl P and Kalra DV. Supply chain management: Strategy, Planning, and Operation, 2016. Pearson Education, India	
2.	Kuldeepak Singh A Handbook on Supply Chain Management : A practical book which quickly covers basic concepts & gives easy to use methodology and metrics for day-to-day problems, challenges and ambiguity faced by executives in decision making, 2021.Notion Press, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Visit to agri-input markets - seed firms to acquire firsthand knowledge on the firm's capital, finance and marketing management	**2.5 hours**
2.	Visit to agri-input markets - fertilizers, firms to acquire firsthand knowledge on the firm's capital, finance and marketing management	**2.5 hours**
3	Visit to agri-input markets - pesticides firms to acquire firsthand knowledge on the firm's capital, finance and marketing management	**2.5 hours**
4	Study of output markets: grains	**2.5 hours**
5	Study of output markets: fruits & vegetables	**2.5 hours**
6	Study of output markets: flowers	**2.5 hours**
7	Study of product markets, retails trade commodity trading and value-added products.	**2.5 hours**
8	Study of financing institutions - cooperatives	**2.5 hours**
9	Study of financing institutions - commercial banks, & RRBs	**2.5 hours**
10	Study of financing institutions - Agribusiness Finance Limited and NABARD	**2.5 hours**
11	Trend and growth rate of prices of agricultural commodities	**2.5 hours**
12	Preparations of projects and feasibility reports for agribusiness	**2.5 hours**

	entrepreneur.	
13	Appraisal/evaluation techniques of identifying viable project and non-discounting techniques.	**2.5 hours**
14	Net present worth technique, internal rate of return for selection of viable project.	**2.5 hours**
15	Case study of agro-based industries	**2.5 hours**
16.	Seminar on selected topics	**2.5 hours**
	Total Laboratory Hours	**40**

Text Books	
1.	Subba Reddy, S and P. Raghu Ram. Agricultural Finance and Management. 2018. Oxford & IBH Publishing Company Private Ltd., India.
2.	Freddie L. Barnard, John C. Foltz, and Elizabeth A. Yeager. 2016. Agribusiness Management. 5th edition, Routledge. UK.
Reference Books	
1.	Chopra S, Meindl P and Kalra DV. Supply chain management: Strategy, Planning, and Operation, 2016. Pearson Education, India
2.	Kuldeepak Singh A Handbook on Supply Chain Management : A practical book which quickly covers basic concepts & gives easy to use methodology and metrics for day-to-day problems, challenges and ambiguity faced by executives in decision making, 2021.Notion Press, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28/02/2024		
Approved by Academic Council	No.73	**Date**	14/03/2024

Course code	**Agricultural Journalism**	**L**	**T**	**P**	**C**
AEXAG305		**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
AEXAG102	Fundamentals of Agricultural Extension Education	1.0			

Course Objectives: The course is aimed at

1. Explaining the importance of journalism in agricultural extension
2. Demonstrating communication media's role in presenting agricultural stories
3. Developing editing, copy reading, title writing, proofreading and lay outing skills.

Expected Course Outcome: At the end of the course the student should be able to

1. Acquire knowledge on agricultural journalism
2. Comprehend the kinds and functions of newspapers and magazines
3. Analyze the various types of agricultural stories
4. Analyze readability of different news stories published in newspapers/ magazines
5. Develop skills in Copy reading, headline/ title writing, proofreading and lay outing
6. Practice agricultural journalism

Module:1	**Agricultural Journalism**	**4 hours**
Nature and scope of agricultural journalism, characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.		
Module:2	**Newspapers and magazines**	**6 hours**

Newspapers and magazines as communication media: Characteristics, kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.		
Module:3	**Agricultural story and Information**	**6 hours**
The agricultural story: Types of agricultural stories, subject matter and structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services and other agricultural news sources.		
Module:4	**Writing the story**	**4 hours**
Organizing the material, treatment of the story, writing the news lead and the body		
Module:5	**Readability measures**	**2 hours**
Readability- definition, formula		
Module:6	**Illustrating agricultural stories**	**4 hours**
Use of photographs, use of artwork-graphs, charts and maps and writing captions		
Module:7	**Editorial mechanics**	**4 hours**
Copy reading, headline and title writing, proofreading and lay outing.		
Module:8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**

Text Books	
1.	Rana, & Priyanka. Textbook of Agricultural Journalism, 2022. Sibt Publications, India.
2.	Robert William Trullinger. Needed, a Profession of Agricultural Journalism, 2018. Forgotten Books. U.K.
Reference Books	
1.	Brown AH and Timothy DG. 2016. The essentials of instructional design: connecting fundamental principles with process and practice, 3rd edition, Routledge, U.K.
2.	Das Samares, Kumar Mondal Sagar. Agricultural Extension & Rural Journalism with Practical. 2018. Kalyani Publishers, India.
Mode of assessment: Assignment, Mid-semester and Final assessment test	

Indicative Experiments		
1.	Practice Interviewing-Preparation of questions/checklist	2.5 hours
2.	Practice Interviewing	2.5 hours
3.	Covering Agricultural Events	2.5 hours
4.	Abstracting stories from research and scientific materials	2.5 hours
5.	Abstracting stories from wire services	2.5 hours
6.	Writing different types of agricultural stories – Expository and Descriptive	2.5 hours
7.	Writing different types of agricultural stories - Persuasive / Argumentative, Narrative	2.5 hours
8.	How to use pictures to tell the news on newspapers?	2.5 hours
9.	How to use pictures to tell the news on magazines?	2.5 hours
10.	How to use pictures to tell the news on online publications?	2.5 hours
11	Practice in editing, copy reading, headline and title writing	2.5 hours
12	Practice in headline and title writing	2.5 hours
13	Practice in proof-reading and lay outing	2.5 hours

14	Testing copy with a readability formula	2.5 hours
15	Visit to a publishing office to comprehend the art of news editing and broadcasting	2.5 hours
16	Visit to a Radio/TV station to comprehend the art of news editing and broadcasting	2.5 hours
	Total Laboratory Hours	**40**

Text Books	
1.	Rana, & Priyanka. Textbook of Agricultural Journalism, 2022. Sibt Publications, India.
2.	Robert William Trullinger. Needed, a Profession of Agricultural Journalism, 2018. Forgotten Books. U.K.
Reference Books	
1.	Brown AH and Timothy DG. 2016. The essentials of instructional design: connecting fundamental principles with process and practice, 3rd edition, Routledge, U.K.
2.	Das Samares, Kumar Mondal Sagar. Agricultural Extension & Rural Journalism with Practical. 2018. Kalyani Publishers, India.

Mode of Evaluation: Internal assessments and Final assessment test			
Recommended by Board of Studies	28/02/2024		
Approved by Academic Council	No.73	**Date**	14/03/2024

Course Code	**Course Title**	**L**	**T**	**P**	**C**
HORAG308	**Hi-tech. Horticulture**	**2**	**0**	**2**	**3**
Pre-requisite		**Syllabus version**			
HORAG101	Fundamental of Horticulture	1.0			

Course Objectives: The course is aimed at

Imparting knowledge on advanced techniques in horticulture.
Describing the techniques involved in protected and precision farming
Developing practical skills pertaining to Hi-tech horticulture

Expected Course Outcomes: At the end of the course students should be able to

1. Appreciate the scope of hi-tech horticulture.
2. Comprehend modern techniques involved in micropropagation, nursery and field management.
3. Acquire a detailed knowledge on protected horticulture
4. Manage water, nutrients and space involving modern techniques
5. Apply and suggest precision farming techniques for horticulture
6. Recommend hi-tech horticultural technologies for crop improvement

Module: 1	**Importance**	**4 hours**
Introduction and importance; Nursery management and mechanization; micro propagation of horticultural crops.		
Module: 2	**Modern Techniques**	**6 hours**
Modern field preparation and planting methods. Micro propagation of horticultural crops.		
Module: 3	**Protected Horticulture**	**6 hours**
Protected cultivation: advantages, controlled conditions, methods, techniques and integrated management of nutrients, pests and diseases.		
Module: 4	**Water and Nutrient**	**4 hours**

Micro irrigation systems and its components. EC, pH- b a s e d fertilizer scheduling.		
Module: 5	**Canopy Management**	**6 hours**
Canopy management, high density Orcharding.		
Module: 6	**Precision Farming**	**2 hours**
Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS) and Variable Rate applicator (VRA).		
Module: 7	**Application of Precision Farming**	**2 hours**
Application of precision farming in horticultural crops-fruits, vegetables and ornamental crops. Mechanized harvesting of produce.		
Module: 8	**Contemporary Issues**	**2 hours**
Lecture by industrial expert		
	Total Lecture hours:	**32**

Text Book		
1	Chandan Singh, A., Jitendrs Kumar and D K Singh. Hi-tech horticulture nursery management. 2017. S.K. Book Agency, India.	
Reference Books		
1.	Pedersen, Soren Marcus, Lind and Kim Martin. Precision Agriculture: Technology and Economic Perspectives. 2017. Springer, Berlin, Germany.	
2.	Nancy Ross. Hydroponics: The complete guide to hydroponics for Beginners. 2018. Publish Drive; Publish Drive edition.	
Mode of Evaluation: Assignment, Mid-term and Final assessment test		
Indicative Experiments		
1.	Types of polyhouses	**2.5 hours**
2.	Types of polyhouses-attached polyhouses	**2.5 hours**
3.	Types of polyhouses-detached polyhouses	**2.5 hours**
4.	Shade net houses	**2.5 hours**
5.	Intercultural operations	**2.5 hours**
6.	Hand tools and equipment identification and application	**2.5 hours**
7.	Power tools and equipment identification and application	**2.5 hours**
8.	Micro propagation-I	**2.5 hours**
9.	Micro propagation-II	**2.5 hours**
10.	Nursery-protrays	**2.5 hours**
11.	Micro-irrigation	**2.5 hours**
12.	EC, pH-based fertilizer scheduling	**2.5 hours**
13.	Canopy management-I	**2.5 hours**
14.	Canopy management-II	**2.5 hours**
15.	Visit to hi-tech orchard	**2.5 hours**
16.	Visit to hi-tech industry	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Books		
1.	Rajendra Singh Rathore, Praveen K Singh, Rajiv K Narolia and Raksha Pal Singh. Hi-tech Horticulture: Approaches for Cultivation and Value Addition. 2021. Om Publications, India.	
Reference Books		
1.	Sachin Tyagi. Improved Production Techniques: Vol.03: Hi Tech Horticulture. 2019. New India Publishing Agency, India.	
2.	Chandan Singh, A., Jitendrs Kumar and D K Singh. Hi-tech horticulture	

	nursery management. 2017. S.K. Book Agency, India.			
Mode of assessment: Internal assessments and Final assessment				
Recommended by Board of Studies	28-02-2024			
Approved by Academic Council	No. 73	**Date**	14-03-2024	

Course Code	**Commercial Plant Breeding**	**L**	**T**	**P**	**C**
PBGAG307		**1**	**0**	**4**	**3**
Pre-requisite		**Syllabus version**			
GPBAG202	Fundamentals of Plant Breeding	1.0			

Course Objectives: The course is aimed at

1. Imparting knowledge on commercial hybrid seed production.
2. Applying biotechnological techniques to conventional plant breeding.
3. Describing the norms involved in testing and release of crop varieties in India.

Course Outcomes: At the end of the course the student should be able to

1. Understand the concepts of producing a male sterile, maintainer and restorer line.
2. Define hybrid seed production techniques across field crops
3. Choose plant biotechnological tools and IPR to promote crop improvement
4. State the norms involved in crop variety release and seed production
5. Develop knowledge for advancement of plant varieties
6. Practice hybridization and plant breeding

Module:1	**Hybrid development**	**2 hours**
Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops-A/B/R and two line system for development of hybrids and seed production.		
Module:2	**Hybrid seed production**	**2 hours**
Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea and Brassica.		
Module:3	**Seed production in protected environment**	**3 hours**
Quality seed production of vegetable crops under open and protected environment.		
Module:4	**Biotechnological tools**	**2 hours**
Alternative strategies for the development of line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.		
Module:5	**IPR**	**2 hours**
IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act.		
Module:6	**Variety release**	**2 hours**
Variety testing, release and notification systems in India.		
Module:7	**Seed production**	**2 hours**
Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.		
Module:8	**Contemporary Issues**	**1 hour**
Lecture by Industrial Expert		
	Total Lecture hours:	**16**

Text Book

1.	Phundan S. and Bisen P. Commercial Plant Breeding. 2020. 1st edition. Daya Publishing House, India.

Reference Books		
1.	Ram, Hari Har. Plant breeding and genetics. 2019.1st edition. New India Publishing Agency, India.	
2.	Phundhan, S. Essentials of Plant Breeding. 2018. 7th edition, Kalyani Publishers, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Floral biology of self pollinated species; Selfing and crossing techniques.	**5 hours**
2.	Floral biology of cross pollinated species; Selfing and crossing techniques.	**5 hours**
3.	Techniques of seed production in self and cross pollinated crops using A/B/R and two line system.	**5 hours**
4.	Learning techniques in hybrid seed production using male-sterility in field crops.	**5 hours**
5.	Understanding the difficulties in hybrid seed production.	**5 hours**
6.	Tools and techniques for optimizing hybrid seed production.	**5 hours**
7.	Concept of rouging in seed production plot.	**5 hours**
8.	Concept of line, its multiplication and purification in hybrid seed production.	**5 hours**
9.	Role of pollinators in hybrid seed production.	**5 hours**
10.	Hybrid seed production techniques in sorghum, pearl millet and maize	**5 hours**
11.	Hybrid seed production techniques in rice, rapeseed-mustard, and sunflower	**5 hours**
12.	Hybrid seed production techniques in castor, pigeon pea, cotton and vegetable crops.	**5 hours**
13.	Sampling and analytical procedures for purity testing and detection of spurious seed	**5 hours**
14.	Seed drying and storage structure in quality seed management.	**5 hours**
15.	Screening techniques during seed processing-grading and packaging.	**5 hours**
16.	Visit to public private seed production and processing plants.	**5 hours**
	Total Laboratory Hours	**80**
Text Book		
1.	Singh, B.D. Shekhawat, N.S. Plant Breeding in 21st century. 2019. Scientific publishers, India.	
Reference Books		
1.	Sharma, A.K. Plant Breeding Fundamentals and Applications.2022. Nipa Genx Electronic Resources & Solutions P. LTD, New Delhi, India	
2.	Phundhan. S., Bisen, B. and Tiwari, R. Commercial Plant Breeding at a Glance. 2021. Daya Publishing House, India.	
Mode of Evaluation: Internal assessments and Final assessment test		

Recommended by Board of Studies	28-02-2024		
Approved by Academic Council	No.73	**Date**	14-03-2024

Course code	System simulation and Agro-advisory	L	T	P	C
COMAG302		2	0	2	3
Pre-requisite		Syllabus version			
AGRAG205	Introductory Agro-meteorology & Climate Change	1.0			

Course Objectives: The course is aimed to

1. Demonstrate the role of crop models in studying soil, plant and water relationship
2. Discuss about different types of crop growth models to forecast crop yields
3. Outline the preparation of agro advisory bulletin based on weather forecast

Expected Course Outcome: Upon completion students will be able to

1. Illustrate crop model concepts and soil-plant-atmospheric continuum
2. Summarize the importance of crop growth models to increase crop production
3. Develop yield models for different crops to predict yield
4. Comprehend weather forecasting
5. Explain about various simulation models for preparation of agro advisories
6. Make use of crop models and statistical approaches to predict yield of crops, forecast pests and diseases and prepare agro-advisories

Module:1	Soil-plant-atmospheric continuum	3 hours

System approach for representing soil-plant-atmospheric continuum, system boundaries,

Module:2	Crop Models	3 hours

Crop models, concepts & techniques, types of crop models, data requirements, and relational diagrams.

Module:3	Crop growth models and validation	7 hours

Evaluation of crop responses to weather elements; Elementary crop growth models; Calibration, validation, verification and sensitivity analysis.

Module:4	Crop production estimation under limited conditions	6 hours

Potential and achievable crop production, concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Module:5	Weather forecasting	4 hours

Weather forecasting, types, methods, tools, techniques and forecast verification. Value added weather forecast, ITK for weather forecast and its validity. Crop-weather calendars.

Module:6	Agro-advisory	4 hours

Preparation of agro-advisory bulletin based on weather forecast.

Module:7	Crop simulation	3 hours

Use of crop simulation model for preparation of agro-advisory and its effective dissemination.

Module:8	Contemporary Issues	2 hours

Lecture by industrial expert

Total Lecture hours:	32

Text Book

1. Mahi, G.S. and P.K. Kingra. Fundamentals of agrometeorology and climate change. 2018. Kalayani Publishers, India.

Reference Book

1. S.R.Reddy. Introduction to agriculture and agrometeorology. 2019. Kalayani Publishers,India.

2.	B. M. Mote and D. D. Sahu. Principles of Agricultural Meteorology. 2017. Scientific Publishers, India.	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Preparation of crop weather calendars.	**2.5 hours**
2.	Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.	**2.5 hours**
3.	Working with statistical models for crop growth.	**2.5 hours**
4.	Working with simulation models for crop growth	**2.5 hours**
5.	Crop yield forecasting models, potential and achievable production – Part I	**2.5 hours**
6.	Crop yield forecasting models, potential and achievable production – Part II	**2.5 hours**
7.	Insect forecasting models for crop protection	**2.5 hours**
8.	Crop disease forecasting models for effective control measures – Part I	**2.5 hours**
9.	Crop disease forecasting models for effective control measures – Part II	**2.5 hours**
10.	Simulation with limitations of water management options.	**2.5 hours**
11.	Simulation with limitations of nutrient management options	**2.5 hours**
12.	Sensitivity analysis of varying weather and crop management practices – Part I	**2.5 hours**
13.	Sensitivity analysis of varying weather and crop management practices – Part II	**2.5 hours**
14.	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast – Part I	**2.5 hours**
15.	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast – Part II	**2.5 hours**
16.	Feedback from the farmers about agro-advisory.	**2.5 hours**
	Total Laboratory Hours:	**40**
Text Book		
1.	Pratik Sanodiya and Rani Lakshmi Bai. Introductory Agro Meteorology and Climate Change. 2019. Akinik Publications, India.	
Reference Books		
1.	B. M. Mote & D. D. Sahu. Principles of Agricultural Meteorology. 2017. Scientific Publishers, India.	
2.	S.R.Reddy. Introduction to Agriculture and Agrometeorology. 2019. Kalayani Publishers,India.	
Mode of evaluation: Internal Assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	73	**Date** 14-03-2024

Course code	Food Safety and Standards	L	T	P	C
FSNAG302		2	0	2	3
Pre-requisite		Syllabus version			
BICAG101	Fundamentals of Plant Biochemistry and Biotechnology	1.0			

Course Objectives: The course is aimed at

1. Inculcating the concept of food safety
2. Understanding different types of food standards
3. Analysing food safety standards and their role in safety management

Expected Course Outcome: At the end of the course the student should be able to

1. Learn the fundamentals of food safety
2. Understand the role of safety and hygiene in food industry
3. Comprehend food regulatory laws and standards
4. Analyse packaging and labelling requirements
5. Appraise the role of food safety management system
6. Integrate newer concepts in food safety

Module:1	Fundamentals of Food Safety	4 hours

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need.

Module:2	Parameter Control	5 hours

Process parameters and their importance in food safety; Control of parameters. Temperature control. Food storage requirements for different food products, Storage management, Product design

Module:3	Hygiene and Sanitation	4 hours

Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures.

Module:4	Food Safety Management	4 hours

Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis.

Module:5	Packaging and Labelling	4 hours

Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene, Packaging, Product labeling and Nutritional labeling.

Module:6	Food Laws and standards	5 hours

Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food.

Module:7	Emerging Trends	4 hours

Recent concerns- New and Emerging Pathogens. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Module:8	Contemporary Issues	2 hours

Lecture from industry expert

Total Lecture hours:	32

Text Book

1. Pieternel A, Luning, Willem J. Marcelis, Food Quality Management Technological

	and Managerial principles and practices, 2020, 3rd Edition, Wageningen Academic Publishers, Netherland.	
Reference Books		
1.	Shapton, D A, Principles and Practices for the Safe Processing of Foods, 1998, CRC Press, USA	
2.	DeMan, Principles of Food Chemistry, 2019, 3rd edition, Springer, USA	
Mode of assessment: Assignment, Mid-semester and Final assessment test		
Indicative Experiments		
1.	Determination of gluten content	**2.5 hours**
2.	Studies on browning of fruits and vegetables	**2.5 hours**
3.	Physical and chemical analysis of water	**2.5 hours**
4.	Preparation of different types of media	**2.5 hours**
5.	Microbiological examination of water and food samples	**2.5 hours**
6.	Assessment of personal hygiene	**2.5 hours**
7.	Assessment of surface sanitation by swab method	**2.5 hours**
8.	Assessment of surface sanitation by rinse method	**2.5 hours**
9.	Biochemical tests for identification of bacteria; Scheme for the detection of food borne pathogens.	**2.5 hours**
10.	Preparation of plans for implementation of FSMS-HACCP, ISO: 22000.	**2.5 hours**
11.	Nutritional labelling	**2.5 hours**
12.	Detection of adulterants in food samples	**2.5 hours**
13.	Analysis of moisture content on the given food sample	**2.5 hours**
14.	Assessment of composition of the given food sample and compare with standards	**2.5 hours**
15.	Visit to a food industry	**5 hours**
16.	Visit to a food industry	**2.5 hours**
	Total Laboratory Hours	**40**
Text Book		
1.	Cruz Rui, Methods in food analysis, 2020, Taylor and Francis Publishers, United Kingdom	
Reference Books		
1.	DeMan, Principles of Food Chemistry, 2019, 3rd edition, Springer, USA	
2.	Suzanne Nielsen S, Food Analysis, 2017, Springer New York Dordrecht Heidelberg, 5th Edition, London	
Mode of Evaluation: Internal assessments and Final assessment test		
Recommended by Board of Studies	28-02-2024	
Approved by Academic Council	No.73 **Date**	14-03-2024