Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

NAAC- 'A $^{+}$' Grade

CIRCULAR NO.SU/ Sci./College/NEP-2020/73/2025

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/ Ad-hoc Boards/Committee and recommended by the Dean, Faculty of Science & Technology, the Academic Council at its meeting held on 09 May 2025 has been accepted **the following B.Sc. Course Structure & Curriculum** under the Faculty of Science & Technology as per National Education Policy – 2020 run at the Affiliated Colleges of Dr. Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	B.Sc. Physics	IIIrd and IVth Semester
2	B.Sc. Electronics	IIIrd and IVth Semester
3	B.A. / B.Sc. Mathematics	IIIrd and IVth Semester
4	B.Sc. Industrial Chemistry	IIIrd and IVth Semester
5	B.Sc. Agrochemical and Fertilizer	IIIrd and IVth Semester
6	B.Sc. Horticulture	IIIrd and IVth Semester
7	B.Sc. Biochemistry	IIIrd and IVth Semester
8	B.Sc. Botany	IIIrd and IVth Semester
9	B.Sc. Zoology	IIIrd and IVth Semester
10	B.Sc. Biotechnology	IIIrd and IVth Semester
11	B.Sc. Microbiology	IIIrd and IVth Semester
12	B.Sc. Diary Science and Technology	IIIrd and IVth Semester
13	B.Sc. Statistics	IIIrd and IVth Semester
14	B.Sc. Computer Science	IIIrd and IVth Semester
15	B.Sc. Geology	IIIrd and IVth Semester
16	B.Sc. Chemistry	IIIrd and IVth Semester
17	B.Sc. Analytical Chemistry	IIIrd and IVth Semester
18	B.Sc. Polymer Chemistry	IIIrd and IVth Semester
19	B.Sc. Environmental Science	IIIrd and IVth Semester
20.	B.Sc. Fisheries Science	IIIrd and IVth Semester

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21.	B.Sc. Home Science	IIIrd and IVth Semester
22.	B.Sc. Data Science	IIIrd and IVth Semester
23.	B.Sc. Information Technology	IIIrd and IVth Semester
24.	B.Sc. Networking and Multimedia	IIIrd and IVth Semester
25.	B.Sc. Automobile Technology	IIIrd and IVth Semester
26.	B.Sc. Forensic Science	IIIrd and IVth Semester
27.	B.Sc. Forensic Science & Cyber Security	IIIrd and IVth Semester
28.	B.Sc. Non-Conventional & Conventional Energy	IIIrd and IVth Semester
29.	B.Sc. Clinical Laboratory Science	IIIrd and IVth Semester
30.	Bachelor of Computer Application	IIIrd and IVth Semester

This is effective from the Academic Year 2025-26 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
-431 004.
Ref.No. SU/Sci./2025/ 827-29
Date:- 26/05/2025

Deputy Registrar,
Syllabus Section.

Copy forwarded and necessary action to :-

1] **The Principal of all Affiliated Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

JD*26052025/-

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar-431001

B.Sc. Degree Programme

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

Course Structure

(AS PER NEP-2020)

Subject (Major): Agrochemicals and Fertilizers

Effective from 2025-26

Dean Faculty of S&T

Dr. M. A. Sakhare
Chairman
Ad-hoc Board in Agrochemicals & Fertilizers and Horticulture
Dr.Babasaheb Ambedkar Marathwada University, Chha.Sambhajinagar

Course Structure, Template of Curriculum

and

Coding Scheme

Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options

Subject(Major): Agrochemicals and Fertilizers

BSc Second Year: 3rd Semester

Students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)

Course Type	Course Code	Examination Code	Course Name	Teaching Scheme (Hrs /Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	AGF/DSC/T/200	SAC00202003T	**Fertilizers-I**	2		2		2+2+2+2= 08
	AGF/DSC/T/201	SAC00202013T	**Biochemistry**	2		2		
	AGF/DSC/P/226	SAC00202263P	**Lab Course-3**		4		2	
	AGF/DSC/P/227	SAC00202273P	**Lab Course-4**		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	AGF/Mn/T/200	SCC00202003T	To be chosen from other discipline of same faculty	2		2		2+2 = 04
	AGF/Mn/T/201	SCC00202013T	To be chosen from other discipline of same faculty	2		2		
Generic / Open Elective (GE/OE)(Choose any one from pool of courses)**It should be chosencompulsorily from the faculty other than that of Major**	AGF/GE/OE/T/200	SDC00202003T	To be chosen from other faculty	2		2		02
VSC (Vocational Skill Courses)(Choose any one from SUB/VSC/T/ 200 and SUB/VSC/T/ 201) and corresponding Practicals	AGF/VSC/T/200	SEC00202003T	**Qualitative & quantitative analysis for agrochemicals**	1		1		1+1 =02
	AGF/VSC/T/201	SEC00202013T	**Grain Storage Technology**	1		1		
	AGF/VSC/P/226	SEC00202263P	**Practicals on Qualitative & quantitative analysis for agrochemicals**		2		1	
	AGF/VSC/P/227	SEC00202273P	**Practicals on Grain Storage Technology**		2		1	
AEC, VEC, IKS	SUB/AEC/T/200	--	English(Common for all the faculty)	2		2		2 + 2 = 04
	SUB/VEC/T/201	--	Environmental Studies	2		2		
OJT/ FP/CEP/CC/RP	SUB/CC/P/ 226	--	Cultural Activity / NSS,NCC(Common for all thefaculty)		4		2	02
				15	**14**	**15**	**07**	**22**

Minor Courses for other Discipline

AGF/Mn/T/200 :**Vermicomposting**: This is a 2 credit theory course is designed for other discipline.

AGF/Mn/T/201: **Pest and pesticides**: This is a 2 credit theory course is designed for other discipline.

Generic /Open Elective Courses for other faculty:

AGF/GE/OE/T/200: **Soil Science**: This is a 2 credit theory course is designed for other faculty.

Detailed Illustration of Courses included in 3rd and 4th semester:

1) **Major** (Core) subject are mandatory.

AGF/DSC/T/200: This is a 2 credit theory course corresponding to Major (core) subject

AGF/DSC/T/201: This is a 2 credit theory course corresponding to Major (core) subject

AGF/DSC/P/226: This is a 2 credit practical course based on SUB/DSC/T/200

AGF/DSC/P/227: This is a 2 credit practical course based on SUB/DSC/T/201

AGF/DSC/T/250: This is a 2 credit theory course corresponding to Major (core) subject
AGF/DSC/T/251: This is a 2 credit theory course corresponding to Major (core) subject
AGF/DSC/P/276: This is a 2 credit practical course based on SUB/DSC/T/250

AGF/DSC/P/277: This is a 2 credit practical course based on SUB/DSC/T/251

2) **Minor : It is from different discipline of the same faculty**

AGF/Mn/T/200: This is a 2 credit theory from different discipline of the same faculty

AGF/Mn/T/201: This is a 2 credit theory from different discipline of the same faculty

AGF/Mn/T/250: This is a 2 credit theory from different discipline of the same faculty
AGF/Mn/T/251: This is a 2 credit theory from different discipline of the same faculty

3) **Generic / Open Elective (GE/OE)**: (Needs to be chosen (any one) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

AGF/GE/OE/T/200 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

AGF/GE/OE/T/250: This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

4) VSC (Vocational Skill Courses): Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

AGF/VSC/T/200 :This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

AGF/VSC/T/201 :This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

AGF/VSC/P/226: This is a 1 credit practical course based on **SUB/VSC/T/200**

AGF/VSC/P/227: This is a 1 credit practical course based on **SUB/VSC/T/201**

5) SEC (Skill Enhancement Courses): Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.

AGF/SEC/T/250: This is a 1 credit theory course to enhance the technical skills of the students in specific area.
AGF/SEC/T/251: This is a 1 credit theory course to enhance the technical skills of the students in specific area.

AGF/SEC/P/276: This is a 1 credit practical course based on **SUB/SEC/T/250**

SUB/SEC/P/277: This is a 1 credit practical course based on **SUB/SEC/T/251**

6) **AEC** (Ability Enhancement courses): The focus of these courses should be based on linguistic and communication skills.

SUB/AEC/T/200 :English

This is a 2 credit theory course based on linguistic proficiency.

SUB/AEC/T/250: Modern Indian Language MIL-2 (Hindi/ Marathi/ Pali& Buddhism/ Sanskrit/ Urdu)

This is a 2 credit theory course based on linguistic proficiency. Students will have to choose one of the above mentioned languages.

7) **VEC** : Environmental Studies

SUB/VEC/T/201: Environmental Studies

This is 2-credit theory course based on Environmental Studies.

8) FP-1 : Field Project :

SUB/FP/P/276 :This is a 2 credit course, should be corresponding to Major (core) subject

9) **CC** (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Preforming Arts.

SUB/CC/P/226 : Cultural Activity / NSS, NCC

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

SUB/CC/P/277 : Fine/ Applied/ Visual/ Performing Arts

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

AGF/DSC/T/200 : Fertilizers-I

Total Credits :02 | Total Contact Hours : 30 Hrs | Maximum Marks :50

Learning Objectives of the Course:

- To provide the Basics of fertilizers and its role on plant growth.
- To know about advantages and disadvantages of fertilizers.
- To provide the knowledge about Nitrogenous and Phosphatic fertilizers.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the basic concepts of fertilizers and its importance.
CO 2: Identify the importanceof fertilizers in crop cultivation.
CO 3: Understand the manufacturing process of Nitrogenous and Phosphatic fertilizers.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction of Fertilizers:** Introduction, classification, composition of fertilizers, advantages and disadvantages of fertilizers, application of fertilizers, Essential element and their role in plant growth, micronutrient fertilizers, complex fertilizers, Nano-fertilizers, Bio-fertilisers.	**10 Hrs**
II	**Nitrogenous Fertilizers:** Sources, fundamental processes involved in manufacturing procedures for ammonia, sulphuric acid, nitric acid and phosphoric acid. Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride and urea. Slow release N fertilizers , coated fertilizers, types of coating , lac coated ,neem cake blended and coal tar coated urea.	**10 Hrs**
III	**PhosphaticFertilizers:** Introduction classification manufacturing process and properties of super phosphate. Granulation, storage and handling, role of phosphate, rock phosphates, triple super phosphate.	**10 Hrs**

TextBooks:

1. Das P. C., Manures and fertilizers Rept. 2015, Kalyani Publishers Pvt. Ltd., New Delhi
2. Gupta A. K. and Varshney M. L., Practical manual for Agril. Chemistry, Kalyani Publishers Pvt. Ltd., New Delhi
3. Nagornny V. D. and Raghav J. S., Soil Fertility Management Rept. 2015, Kalyani Publishers Pvt. Ltd., New Delhi.
4. R. Langdon, Elsworth, Paley, W.O. Fertilizers: Properties, Application and Effect, Nova Science Pub 2008.

AGF/DSC/T/201 : Biochemistry

Total Credits : 02 Total Contact Hours : 30 Hrs Maximum Marks : 50

Learning Objectives of the Course:

- To know the basic concepts of biochemistry.
- To know the about carbohydrates and lipids.
- To provide the knowledge about proteins and amino acids

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the basic concepts of biochemistry and role of enzymes.
CO 2: Identify the significance of carbohydrates.
CO 3: Understand the basic knowledge of protean and amino acids.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Biochemistry:** Definition, scope and importance of biochemistry in agriculture. definition of enzyme, classification, properties, role of enzyme as a biological catalysis.	**10 Hrs**
II	**Carbohydrate and Lipids:** **Carbohydrate:** Definition, classification, structure and properties of carbohydrates biological significance of carbohydrate. **Lipids:** Introduction, definition, structure, component of fatty acid, classification of lipids, properties of fats and oil, biological significance of lipids.	**10 Hrs**
III	**Proteinand Amino Acid:** **Protein**: Introduction, definition, classification, properties and structure of protein, qualitative test for identification of protein. **Amino acid**: Definition,structure, classification and properties of amino acid.	**10 Hrs**

Text Books:

1. HarbansLal, AshumaSachdeva. "Textbook of biochemistry"CBS Publishers and Distributors PVT LTD. (18 June 2021)
2. J. L. Jain "Fundamentals of biochemistry"S. Chand Publishing, 2000
3. Dr. M. Naveen, Dr. K Praveen "A Textbook of Applied Biochemistry" Nightingale publication. 2024.
4. West and Todd. "Textbook of biochemistry"
5. U. Satyanarayan and U. Chakrapani "Essentials of biochemistry"
6. H.P. Gajera, S.V. Patel, B.A. Golakiya, "Fundamentals of biochemistry"

AGF/DSC/P/ 226: Laboratory course-3

Total Credits : 02 Total Contact Hours : 60 Hrs Maximum Marks : 50

Learning Objectives of the Course:

- To provide identification skills of Manures and Fertilizers
- To know the analysis and estimations methods of fertilisers.
- To inculcate the skill of analysis of fertilisers.

Course Outcomes (COs) :

After completion of the course, students will be able to-

CO 1: Understand the identification skills of Manures and Fertilizers.

CO 2: Learn about the various nutrients (N, P, K) and other elements present in different fertilizers.

CO 3: Understand the different types of fertilisers.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Identification of different manures and fertilizers 2. Estimation of Moisture and mineral matter from organic Manures (FYM/compost/oil Cake). 3. Estimation of organic carbon from FYM or Compost (Walklay and Black Method) 4. Determination of Acidity (in terms of H_2SO_4) of ammonium Sulphate. 5. Determination of purity percentage of ammonium sulphate. 6. Estimation of water soluble phosphate from super phosphate.	**20 Hrs**
II	1. Estimation of water soluble phosphate from super phosphate. 2. Determination of water soluble calcium from super Phosphate. 3. Estimation of available zinc from fertilizer sample. 4. Estimation of manganese from micro nutrient carrier 5. Estimation of molybdenum from micro nutrient carrier. 6. Qualitative test for N-P-K Fertilizer	**20 Hrs**
III	1. Determination of sulphate from super phosphate. 2. Estimation of available NPK by using soil testing kit. 3. Study of different types of biofertilizers. 4. Estimation of copper from micro nutrient carrier. 5. Estimation of nitrogen from urea. 6. Preparation and use of soil testing kit.	**20 Hrs**

Text Books:

1. Hand Book of Agriculture ICAR New Delhi.
2. Manures and Fertilizers by - FAI
3. Analytical Agril. Chemistry by Chopra and Kanwar.
4. Hand Book of Manures and Fertilizers by ICAR New Delhi.
5. Hand Book of Agriculture- ICAR.

AGF/DSC/P/227: Laboratory course-4

Total Credits : 02 | Total Contact Hours : 60 Hrs | Maximum Marks : 50

Learning Objectives of the Course:

- To develop practical knowledge in biochemistry.
- To know the estimation and analysis of carbohydrates and proteins.
- To inculcate the skill of analysis of proteins and carbohydrates.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the basic practical knowledge in biochemistry.
CO 2: Identify the different types of fertilizers.
CO 3: Get knowledge about sugar industry and fertilizer testing lab.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Reparation of normal, molar and buffer solution. 2. Estimation of reducing sugar from cane sugar juice. 3. Estimation of non-reducing sugar from Jaggary. 4. Determination of saponification value from oil sample. 5. Color test of carbohydrates and protein. 6. Estimation of vitamin C from fruit juice.	**20 Hrs**
II	1. Qualitative analysis of carbohydrates by Fehling solution. 2. Qualitative analysis of carbohydrates by osazone test. 3. Qualitative analysis of carbohydrates by Iodine test. 4. Qualitative analysis of reducing sugar by dinitrosalicylic method. 5. Estimation of protean by biuret method. 6. Determination of oil from oilcakes. 7. Visit to sugarcane industry.	**20 Hrs**
III	1. Visit to manure pit and bio gas plant. 2. Visit to fertilizer industry and study of their activities. 3. Visit to fertilizer testing laboratory. 4. Estimation of potassium in fertilizers by flame photometer. 5. Analysis of rock phosphate 6. Analysis of ammonium phosphate 7. Analysis of potassic fertilize	**20 Hrs**

TextBooks:

1. Practical Manual of Biochemistry, Dr. G. Sattanathan, Dr. S.S. Padmapriya, Dr. B. Balamurali Krishna.
2. Laboratory Manual of Biochemistry by Joy P.P., Surya S., Aswathy C. 2015
3. Practical Lab Manual,Rai University
4. Hand Book of Manures and Fertilizers by ICAR New Delhi.
5. Hand Book of Agriculture- ICAR.

AGF/Mn/T/200 : Vermicomposting
(This theory course is designed for other discipline)

Total Credits :02 Total Contact Hours : 30 Hrs. Maximum Marks : 50

Learning Objectives of the Course:

- To provide the knowledge about earthworms.
- To know the about precautions to be taken in preparing vermibeds.
- To know the principle and handling of vermiwash.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the classification of earthworms.
CO 2: Prepare vermicomposting unit.
CO 3: Understand the advantages of vermicomposting

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction of vermicomposting:** Introduction, classification of earthworms, morphology and body parts of earthworms, life cycle of earthworms, handling of earthworms, composting and vermicomposting, role of earthworms in maintaining crop, production and soil fertility, advantages of vermicomposting.	**10 Hrs**
II	**Introduction of vermibed:** Characteristics of a vermibed, site selection for vermicomposting, vermicomposting techniques, procedure for making avermibed, precautions to be taken in preparing vermibeds, maintenance of a vermibed, protecting vermibed.	**10 Hrs**
III	**Vermiwash:** Purpose of vermiwash preparation, principle of vermiwash preparation, preparation of vermiwash, functioning/handling of a vermiwash unit, composition/quality of vermiwash, advantages of the vermiwash spray, benefits of establishing a vermiwash unit.	**10 Hrs**

Text Books:

1. Khushbu, RachnaGulati, Sushma and KomalArya, Fundamentals of Vermicomposting, 2022, AkiNik Publications.
2. Keshav Singh, A Textbook of Vermicompost: Vermiwash and Biopesticides, 2014, Biotech Books.
3. Das P. C., Manures and fertilizers Rept. 2015, KalyaniPublishersPvt. Ltd., New Delhi
4. Gupta A. K. and Varshney M. L., Practical manual for Agril. Chemistry, Kalyani Publishers Pvt. Ltd., New Delhi
5. Nagornny V. D. and Raghav J. S., Soil Fertility Management Rept. 2015, Kalyani
6. Dr.Parveen Gill, Dr.DommalapatiSudhakaraRao and Dr. R.K. Gupta. Organic Farming by Vermicompost (Volume - 1), 2023, AkiNik Publications.
7. Dr. S. Peer Mohamed, From Waste to Gold: The Vermicomposting Handbook, (1 January 2023), Nitya Publications.

AGF/Mn/T/201 : Pest and Bio-pesticide

(This theory course is designed for other discipline)

Total Credits : 02 | Total Contact Hours : 30 Hrs. | Maximum Marks : 50

Learning Objectives of the Course:

- To provide knowledge about different types of pests.
- To provide knowledge and importance of pest management.
- To know about various types of biopesticides.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO1: Understand the concept of pest and their classification.

CO2: Get knowledge about advantages of biopesticides over chemical pesticides

CO3: Get knowledge about active ingredients biopesticides.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Pest:** Definition, introduction, classification of pest, concept of insect pest-definition, life cycle, non insect pests- introduction, weeds, bacteria, birds, mites, nematodes, arthropods, plant pathogens, bacteria, viruses, fungi.	**10 Hrs**
II	**Pest Management :** Integrated pest management, biological pest control, natural methods, pest predators, importance of pest management.physical, chemical, biological, genetic, natural methods for pest control, seed treatments, soil application.	**10 Hrs**
III	**Biopesticides:** Introduction of biopesticides, types of biopesticides, application of biopesticide, need of biopesticide, active ingredients of biopesticides, advantages over chemical pesticides, availability of biopesticides in the market.	**10 Hrs**

Text Books:

1) G. K. Ghosh, Biopesticide& Integrated Pest Management, APH Publishing, New Delhi, 2000
2) Nick Birch and Travis Glare. Biopesticides for Sustainable Agriculture. Burleigh
3) Dodds, Science Publishing Limited
4) Matthews GA, Bateman RP, Miller PCH (2014) Pesticide Application Methods (4^{th}Edition), Chapter 16. Wiley, UK

AGF/GE/OE/T/200 : Soil chemistry
(This theory course is designed for other faculty)

Total Credits : 02 Total Contact Hours : 30 Hrs Maximum Marks : 50

Learning Objectives of the Course:

- To describes the importance of soil and properties of soil.
- To learn the fertility of soil and their effect on productivity
- To know the soil pollution and their impact on soil health and fertility.

Learning Course Outcome (CO): On successful completion of this course student will be able to

CO 1: Get the knowledge of soil and its importance.
CO 2: Understand the concept of soil chemistry.
CO 3: Aware about soil productivity, soil conservation and soil pollution.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction of Soil:** Definition of soil, classification of soil, properties and composition of soil. methods of soil formation, soil profile: definition, soil horizon and typical diagram of soil profile, types of soil horizon, soil components.	**10 Hrs.**
II	**Soil fertility, productivity and soil conservation.** Definition, comparison between fertility and productivity and factors affecting them management of soil productivity. soil conservation: definition, importance, methods of soil conservation in agriculture	**10 Hrs.**
III	**Soil Pollution:** Introduction to soil pollution, definition and importance of soil pollution, sources of soil pollution (natural and anthropogenic), types of soil pollutants, effects of soil pollution: impact on soil health and fertility, effects on plant growth and crop yield, human health risks and environmental impact.	**10 Hrs.**

Text Books:

1. Fundamental of Soil Science: Forth and Turk.
2. Principles of Soil Science: M. M. Rai.
3. Nature and properties of Soil: Bookmannand Brady
4. A text book of soil science: Dr. J. A. Daji.
5. Soil fertility and fertilizer: Tisdleand Nelson
6. Soil Science: P. S. Varma and V. K. Agarwal.
7. Soil fertility: Theory and Practice by J. S. Kanwar
8. Dictionary of Soil and water management by J. R. Kadam, B. P. Ghildyal

AGF/VSC/T/200 : Qualitative and quantitative analysis for agrochemicals

Total Credits :01 | Total Contact Hours : 15 Hrs. | Maximum Marks : 50

Learning Objectives of the Course:

- To provide the knowledge about qualitative and quantitative analysis for agrochemicals.
- To know about different types of agrochemicals.
- To develop practical skill regarding qualitative and quantitative analysis.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Learned the qualitative and qualitative analysis techniques.
CO 2: Study the estimation by using different types of titration methods.
CO 3: Learned about basics knowledge different types of agrochemicals and its important.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Agrochemicals:** Definition, classification, and importance of agrochemicals. Different types of agrochemicals: insecticides, herbicides, fungicides, and fertilizers.	**05 Hrs**
II	**Qualitative analysis:** Introduction, types of qualitative analysis, terms used in qualitative analysis, common ion effect, solubility product, preparation of solutions,	**05 Hrs**
III	**Quantitative analysis :** Volumetric titrations, indicators, theories of acid base indicators, choice of acid base indicators in titration, oxidation reduction titration, silver nitrate titration, complex metric titration, gravimetric estimations.	**05 Hrs**

TextBooks:

1. Soil Testing and Analysis by S.R. Vinodkumar, G.Murugan, R. Rex Immanuel, K. Krishnaprabhu.
2. Advance Practical Inorganic Chemistry by Gurudeep Raj.
3. Qualitative inorganic analysis by A.I. Vogel.
4. A Handbook on soil Analysis by Rishikesh Thakur, AtulkumarShrivastava, G.D. Sharma, B.S. Dwivedi.
5. Soil Science: P. S. Varma and V. K. Agarwal.

AGF/DSC/T/201 : Grain Storage Technology

Total Credits : 01 | Total Contact Hours : 15 Hrs. | Maximum Marks : 50

Learning Objectives of the Course:

- To provide the knowledge about grain storage.
- To understand the methods of grain storage.
- To provide the knowledge about insecticides and pesticides used in grain storage.
- To know the control of physical, chemical & biological spoilage during storage of grains.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1 : Understand the grain storage methods.

CO 2 : Gain knowledge about insect and pests affecting stored grains.

CO 3 : Understand the factors influencing grain losses during storage.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Grain drying:** Moisture content, equilibrium moisture content; free and bound water, rate of drying, constant and falling rate of drying rate; factors affecting rate of drying process, types of dryers used for drying of grains.	**05 Hrs**
II	**Grain storage:** Principles, moisture movement during bulk storage of grains, pressure distribution in storage bins, methods of aeration, grain storage structures -location and material selection for storage building, types - traditional, modern; temporary and permanent storage structures.	**05 Hrs**
III	**Insecticides and Fumigants:** Insects and pests - types, extent of losses during storage, causes and control measures, insecticides - principles, scope of application in warehouses; requirements, group of active ingredients, fumigants - chemicals, areas of application, choice, toxicity, application rates, exposure time and resistance.	**05 Hrs**

Text Books:

1. Integrated Pest Management, Concepts and Approaches - G. S. Dhaliwal and R. AroraAgrobiosindia (2000).
2. A Textbook of Applied Engomology - K. P. Srivastava, AgrobiosInsdia (2000)
3. Elements of Economic Entomology - B. Vasantharaj David, Brillion Publishing (1990)
4. Crop Protections Management Strategies - D. Prasad, Oxford Publishers (2000)
5. Agricultural Insect Pests and their Control - V. B. Awasthi, Mamrutha publishers (2000)
6. A Textbook of Plantation Crops - K. M. Pillai, Oxford Publishers (2002).

AGF/VSC/P/226:Practicals on Qualitative and quantitative analysis for agrochemicals

Total Credits : 01 | Total Contact Hours : 30 Hrs. | Maximum Marks : 50

Learning Objectives of the Course:

- To educate students on the relevance qualitative analysis of inorganic compounds.
- To increase the practical skill in students.
- Develop practical report writing skills and presenting.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Learned the qualitative analysis practical techniques.

CO 2: Study the estimation of Cu, Zn, Ni and Pb.

CO 3: Learned the separation method of acidic and basic radicals.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Detection of two acidic radicals given binary mixture by semi micro qualitative analysis. 2. Detection of two basic radicals given binary mixture by semi micro qualitative analysis. 3. Detection of basic radicals by using spot test reagent.	**10Hrs**
II	4. Estimation of Zn gravimetrically as a zinc ammonium phosphate. 5. Estimation of Mn gravimetrically as manganese ammonium phosphate. 6. Estimation of Ni as Ni-DMG gravimetrically. 7. Estimation of aluminium as aluminium oxalate.	**10Hrs**
III	8. Estimation of Zn by EDTA solution using EBT indicator. 9. Estimation of Ni by EDTA using murexide indicator. 10. Estimation of Cu by EDTA using Fast Sulphon Black F indicator. 11. Estimation of Pb by EDTA using Xylenol orange indicator.	**10Hrs**

Text Books:

1. Soil Testing and Analysis by S.R. Vinodkumar, G.Murugan, R. Rex Immanuel, K. Krishnaprabhu
2. Advance Practical Inorganic Chemistry by Gurudeep Raj
3. Qualitative inorganic analysis by A.I. Vogel
4. A Handbook on soil Analysis by Rishikesh Thakur, AtulkumarShrivastava, G.D. Sharma, B.S. Dwivedi
5. Soil Science: P. S. Varma and V. K. Agarwal.

AGF/VSC/P/227 : Practicals on Grain Storage Technology

Total Credits : 01 | Total Contact Hours : 30 Hrs. | Maximum Marks : 50

Learning Objectives of the Course:

- To provide the skills of grain storage techniques.
- To understand the various methods of grain storage.
- To provide the knowledge about insecticides and pesticides used in grain storage.
- To know the control of physical, chemical and biological spoilage during storage of grains.

Course Outcomes (COs) : After completion of the course, students will be able to –

CO 1 : Determine the bulk density, true density and porosity of grains.
CO 2 : Gain knowledge about demonstration of fumigation of grains.
CO 3 : Understand the storage techniques in commercial godowns.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Determination of bulk density, true density & porosity of grains. 2. Study of designs of storage bins as per capacity requirement. 3. Demonstration of fumigation of grains. 4. Plotting of absorption isotherm and calculation of EMC.	**10Hrs**
II	5. Assessment of weight loss due to insects by count and weight method. 6. Detection of visible and hidden infestation of external and internal feeders. 7. Computation of doses of insecticides in ware house. 8. Visit of commercial godowns.	**10Hrs**
III	9. Identification of common storage insects. 10. Determination of hardness of wheat grains. 11. Determination of vitreousness of wheat grains. 12. Precleaning of wheat grains.	**10Hrs**

Text Books:

1. Integrated Pest Management, Concepts and Approaches - G. S. Dhaliwal and R. AroraAgrobiosindia (2000).
2. A Textbook of Applied Engomology - K. P. Srivastava, AgrobiosInsdia (2000).
3. Elements of Economic Entomology - B. Vasantharaj David, Brillion Publishing (1990).
4. Crop Protections Management Strategies - D. Prasad, Oxford Publishers (2000).
5. Agricultural Insect Pests and their Control - V.B. Awasthi, Mamrutha publishers (2000).
6. A Textbook of Plantation Crops - K. M. Pillai, Oxford Publishers (2002).

BSc Second Year: 4th Semester

Course Type	Course Code	Examination Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	AGF/DSC/T/250	SAC0020250T	**Fertilizers-II**	2		2		2+2+2+2 = 08
	AGF/DSC/T/251	SAC00202504T	**Insecticides**	2		2		
	AGF/DSC/P/276	SAC00202764P	**Lab course-5**		4		2	
	AGF/DSC/P/277	SAC00202774P	**Lab course-6**		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	AGF/Mn/T/250	SCC00202504T	To be chosen from other discipline of same faculty	2		2		2+2 = 04
	AGF/Mn/T/251	SCC00202514T	To be chosen from other discipline of same faculty	2		2		
Generic /Open Elective (GE/OE)(Choose any one from pool of courses)**It should be chosen compulsorily from the faculty other than that of Major**	AGF/GE/OE/T/250	SDC00202504T	To be chosen from other faculty	2		2		02
SEC (Skill Enhancement Courses)(Choose any one from SUB/SEC/T/250and SUB/SEC/T/ 251) and correspondingPractical's	AGF/SEC/T/250	SEC00202504T	**Biofertilizers**	1		1		1+1 =02
	AGF/SEC/T/251	SEC00202414T	**Chromatography technics**	1		1		
	AGF/SEC/P/276	SEC00202764P	**Practical's on Bio fertilizers**		2		1	
	AGF/SEC/P/277	SEC00202774P	**Practical's on Analytical techniques for agrochemicals**		2		1	
AEC, VEC, IKS	SUB/AEC/T/250		Modern Indian Language (MIL-2) (Choose any one from pool of language courses)	2		2		02
OJT/ FP/CEP/CC/RP	SUB/FP/P/ 276	SKC00202764P	**Field Project**		4		2	2+2= 04
	SUB/CC/P/ 277	--	(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	
				13	**18**	**13**	**09**	**22**
Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course (related to major / minor) / Internship during summer vacation OR Continue with Major and Minor.								

Minor Courses for other Discipline

AGF/Mn/T/250 :**Apiculture**: This is a 2 credit theory course is designed for other discipline.

AGF/Mn/T/251: **Sericulture**:This is a 2 credit theory course is designed for other discipline.

Generic /Open Elective Courses for other faculty:

AGF/GE/OE/T/250:**Introduction to Agrochemicals**: This is a 2 credit theory course is designed for other faculty.

AGF/DSC/T/250 : Fertilizers-II

Total Credits : 02 | Total Contact Hours : 30 Hrs | Maximum Marks : 50

Learning Objectives of the Course:

- To provide the basics of plant nutrition and its role on plant growth.
- To know about potassic fertilizers and its manufacturing process.
- To provide the knowledge about Complex and Mixed Fertilizers.

Course Outcomes (COs) :

After completion of the course, students will be able to -

CO 1 : Understand the basics of plant nutrition and its role on plant growth.
CO 2 : Identify therole of Complex and Mixed Fertilizers in plant growth.
CO 3 : Understand theadvantages & disadvantagesPotassic,complex& mixed fertilizers.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Plant Nutrition:** The role of fertilizers in agriculture, concepts of soil fertility. diagnosis of nutrient problems. crop response to fertilizers. secondary and micro plant nutrients. essential plant nutrients, functions and deficiency symptoms of the essential nutrients. forms in which nutrients are utilized by crop plants. how plants absorb nutrients sources of plant nutrients.	**10 Hrs**
II	**Potassic Fertilizers:** Introduction. classification. manufacturing process and properties of muriate of potash potassium sulphate and potassium magnesium sulphate. potash minerals. potassium deficiency symptoms. potassium fertilizer application in crop production.	**10 Hrs**
III	**Complex and Mixed Fertilisers**: Complex fertilizers: introduction, advantages manufacturing process and properties of nitro phosphate ammonium phosphate. mixed fertilizers: introduction, advantages and disadvantages. materials used in mixed fertilizers. method of preparation. granulated fertilizer mixtures.	**10 Hrs**

Text Books:

1. Das P. C., Manures and fertilizers Rept. 2015, KalyaniPublishers Pvt. Ltd., New Delhi.
2. Gupta A. K. and Varshney M. L., Practical manual for Agril. Chemistry, Kalyani Publishers Pvt. Ltd., New Delhi.
3. Nagornny V. D. and Raghav J. S., Soil Fertility Management Rept. 2015, Kalyani Publishers Pvt. Ltd., New Delhi.
4. R. Langdon, Elsworth, Paley, W.O. Fertilizers: Properties, Application and Effect, Nova Science Pub 2008.

AGF/DSC/T/251 : Insecticides

Total Credits : 02 | Total Contact Hours : 30 Hrs | Maximum Marks : 50

Learning Objectives of the Course:

- To provide the information about principals and methods of insect control.
- To know about synthesis and properties of insecticides.
- To provide the knowledge about integrated pest management.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1 : Understand the principals and methods of insect control.
CO 2 :learn about synthesis and properties of insecticides .
CO 3 : Understand the a dvantages and disadvantages of insecticides.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Insecticides**: Introduction and definition. losses caused by insects. classification of insecticides. insecticidal formulations. 12 natural insecticides: pyrethroids and neem based. principals and methods of insect control. physical and mechanical control. cultural control. biological control. chemical control. legal or legislative control.	**10 Hrs**
II	**Insecticides:** Study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, uses, amides and similar functions: rynaxypyr, phthalicdicarboxamide, miscellaneous: fipronil, bifentrin, buprofezin, decamethrin, fenvalerate, imadichloprid, indoxacarb.	**10 Hrs**
III	**Insecticides and Integrated pest management**: Organochlorine insecticides. organo phosphorus insecticides. Carbamates&sulphur containing compounds. syntheticpyrethroids. fumigants. control of stored grain pests. integrated pest management. .	**10 Hrs**

Text Books:

1. The complete technology book on pesticides, insecticides fungicides and herbicides- Dr.Himadri Panda, 2022.
2. Integrated Pest Management Concepts and Approaches- G.D. Dahiwal, Ramesh Arora.
3. Crop Protections Management Strategies - D. Prasad, Oxford Publishers (2000).
4. Agricultural Insect Pests and their Control - V. B. Awasthi, Mamrutha publishers (2000).
5. Pesticide Formulation -Parmar B.S.

AGF/DSC/P/ 276: Laboratory course-5

Total Credits : 02 | Total Contact Hours : 60 Hrs | Maximum Marks : 50

Learning Objectives of the Course:

- To create practical skills of insecticides, pesticides and fungicides.
- To know the estimation and analysis of insecticides, pesticides and fungicides.
- To understand determination methods of contents in insecticides, pesticides and fungicides.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1 : Understand estimation& analyzing methods of insecticides, pesticides &fungicides

CO 2 : Identify the different types of agrochemicals

CO 3 : Get knowledge about agrochemical industry.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Estimation of copper pesticides by iodometric methods. 2. Estimation of zinc from zinc containing fungicides by EDTA method. 3. Estimation of chlorine from dichlorophenyltrichloro ethane (DDT) 4. Estimation of sulphur from sulphur containing fungicide. 5. Estimation of hydrolysable chlorine from BHC	**20 Hrs**
II	1. Determination of moisture content from pesticides/fungicides 2. Estimation of mercury from mercury containing fungicide 3. Determination of percentage purity of zinc fungicide in commercial sample 4. Determination of gamma isomer of BHC by column chromatography. 5. Estimation of phosphorus from given sample of organo phosphorus insecticide	**20 Hrs**
III	1. Gravimetric determination of zinc as pyrophosphate from zinc containingfungicide. 2. Preparation and use of Bordeux mixture Collection and identification of insects/pests. 3. Visit to the Agrochemicals Industry 4. Extraction of pesticide/fungicide from plant material 5. Estimation of Fe^{2+} from $FeSO_4$ from micro nutrient carrier.	**20 Hrs**

Text Books:

1. Qualitative inorganic analysis by A.I. Vogel.
2. Advance Practical Inorganic Chemistry by Gurudeep Raj.
3. Handbook of Pesticides: Methods of Pesticide Residues Analysis, Leo M.L. Mollet, Hamir S. Rathore, Publisher -CRC Press; 1st edition (September 14, 2009)

AGF/DSC/P/ 277: Laboratory course-6

Total Credits : 02 Total Contact Hours : 60 Hrs Maximum Marks : 50

Learning Objectives of the Course:

- To create practical skills of insecticides, pesticides and fungicides.
- To know the estimation and analysis of insecticides, pesticides and fungicides.
- To understand determination methods of contents in insecticides, pesticides and fungicides.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the estimation & analyzing methods of insecticides, pesticides & fungicides.

CO 2: Identify the different types of agrochemicals.

CO 3: Get knowledge about agrochemical industry.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Determination of salinity of soil by conductometrically 2. Estimation of Copper pesticides by iodometric methods. 3. Estimation of zinc from zinc containing fungicides by EDTA method. 4. Estimation of Sulphur from sulphur containing fungicide. 5. Determination of moisture content from pesticides/fungicides 6. Collection and identification of plant diseases.	**20 Hrs**
II	1. Study and market survey of different agricultural chemicals. 2. Study of Plant protection appliances. 3. Preparation and use of Bordeux mixture. 4. Determination of percentage purity of phosphomidon form commercial sample. 5. Study and application of herbicides (demonstration). 6. Extraction of pesticide/fungicide from plant material.	**20 Hrs**
III	1. Collection and identification of weeds. 2. Collection and identification of insects/pests. 3. Visit to the Agrochemicals Industry. 4. Determination of PH/acidity/alkalinity of the formulation. 5. Estimation of Fe2+ from FeSO4 from micro nutrient carrie 6. Analysis of Bordeux mixture.	**20 Hrs**

TextBooks:

1. Advance Practical Inorganic Chemistry by Gurudeep Raj.
2. Qualitative inorganic analysis by A.I. Vogel.
3. Practical Manual Principles of Integrated Pest Management, Prof. D. M. DamasiaDr. J. J. PastagiaMr. H. R. Kachhela, 2019, Asian Printery Nr. Talati Hall, Raipur, Ahmedabad.
4. Handbook of Pesticides: Methods of Pesticide Residues Analysis, Leo M.L. Mollet, Hamir S. Rathore, Publisher -CRC Press; 1st edition (September 14, 2009)

AGF/Mn/T/250 : Apiculture
(This theory course is designed for other discipline)

Total Credits : 02 Total Contact Hours : 30 Hrs Maximum Marks : 50

Learning Objectives of the Course:

- To provide the knowledge about apiculture.
- To know the about precautions to be taken in preparing modern beekeeping,.
- To get knowledge abouthoney processing and bee hive products

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the information of apiculture.
CO 2: Start bee keeping businesses.
CO 3: Understand the knowledge about honey processing andbee hives products.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introductionto Apiculture:** Introduction - scope, importance History of bee keeping: definition, bee keeping in worldwide, in india, traditional bee keeping, modern beekeeping, urban or backyard beekeeping, apiculture development in india - institutions involved. role of central, honey bee research & training institute.	**10 Hrs**
II	**Bee keeping: tools and equipment:** Basic requirements of tools for starting bee keeping: getting started in beekeeping - land and buildings, equipment and supplies, bee keeping equipment - introduction to types of bee boxes - bis standard, tools used in apiculture. bee breeding multiplication of colonies - queen reaching technique.	**10 Hrs**
III	**Honey Processing and Bee Hive Products:** Honey extraction and handling - quality control standards - honey testing kit, processing of honey. other valuable by products of honey bees, bee venom & royal jelly extraction	**10 Hrs**

Text Books:

1. Dr.Saurav Gupta, A Textbook Of Apiculture, 1 January 2024, Write And Print Publications.
2. Dr. D.K.Belsare, Dr.Rakesh Kumar Singh, Dr. Mrs ShashikalaD.Belsare and Mr.RavindraAliaiRavirajHimmatraoDeshmukh, Textbook of Apiculture (Beekeeping), 2019, Himalaya Publishing House.
3. K.V. Jayashree, C. S. Tharadevi, N. Arumugam, Apiculture,2014, Saras Publication.
4. Nagaraja N. and RajagopalD., Honeybees: Diseases, Parasites, Pests, Predators and their Management, 2009, MJP Publishers.

AGF/Mn/T/251 : Sericulture

(This theory course is designed for other discipline)

Total Credits :02 Total Contact Hours : 30 Hrs. Maximum Marks : 50

Learning Objectives of the Course:

- To provide the knowledge about sericulture.
- To know the aboutsilkworm seed production technology.
- To get knowledge about different aspect of the sericulture industry

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the information aboutsericulture.
CO 2: Start sericulture business and silkworm seed production technology
CO 3: Understand the knowledge about different aspect of the sericulture industry

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Sericulture:** Origin and history of sericulture. silk route and map of india and world; temperate and tropical climate for sericulture practice. Textile fibers: natural and synthetic fibers: advantage of silk fiber over other fibers.	**10 Hrs**
II	**Components of sericulture:** Introduction to mulberry and non-mulberry sericulture. Introduction to mulberry cultivation, Introduction to silkworm rearing: Introduction to silkworm seed production, silkworm seed production post cocoon technology. Mulberry species and varieties under cultivation in India. Popular silkworm races of India	**10 Hrs**
III	**Characteristics of sericulture industry:** Land and agro based part of industry. Industrial aspectof the industry; silk reeling as a cottage industry; handloom and power loom activities. Sericulture, prospects and problems of sericulture industry	**10 Hrs**

Text Books:

1. Hand Book of Silkworm rearing (1972); Fuji Publishing Co., Ltd., Tokyo, Japan.
2. Sarkar D.C. (1980); Ericulture in India, Central Silk Board, Government of India,Bangalore.
3. J. SulochanaChetty G. Ganga, An Introduction to Sericulture, 2023,Jain Brothers.
4. Dr.SanjaySarkar, Sericulture, 2022,Technoworld.

AGF/GE/OE/T/250 : Introduction of Agrochemicals
(This theory course is designed for other faculty)

Total Credits :02 Total Contact Hours : 30 Hrs Maximum Marks :50

Learning Objectives of the Course:

- To provide the information about principals and methods of insect, pest & fungal control.
- To know about synthesis and properties of agrochemicals.
- To provide the knowledge about insect and pest management

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the principals and methods of insects, pest and fungal controls.

CO 2 :learn about synthesis and properties of insecticides, pesticides & fungicides.

CO 3: Understand the advantages & disadvantages insecticides, pesticides & fungicides.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Pesticides:** Introduction, classification, uses, synthetic pesticides:organochlorines,organophosphates,carbamates, pyrethroids. bio-based pesticides: microbial pesticides,biochemical pesticides and botanical pesticides. integrated pest management practices. adverse effect of pesticides on animal life.	**10Hrs**
II	**Herbicides**: Introduction, classification, importance, systemicand contact herbicides, properties and applications of glyphosate,2,4-d, paraquat,atrazine,pendimethalin,oxyfluorfen anddicamba. types of herbicide selectivity, impacts of herbicides on environment.	**10Hrs**
III	**Fungicides**: Introduction, classification, properties and uses of mancozeb. carbendazim, copper oxychloride ,sulfur, tricyclazole,chlorothalonil and azoxystrobin. protect crops from fungal infections.adverse effect of fungicides on animal life.	**10Hrs**

Text Books:

1. Integrated Pest Management, Concepts and Approaches - G. S. Dhaliwal and R. AroraAgrobiosindia (2000).
2. Crop Protections Management Strategies - D. Prasad, Oxford Publishers (2000).
3. Agricultural Insect Pests & their Control- V. B. Awasthi, Mamrutha publishers (2000).
4. G. K. Ghosh, Biopesticide& Integrated Pest Management, APH Publishing, New Delhi, 2000.
5. Nick Birch and Travis Glare. Biopesticides for Sustainable Agriculture. BurleighDodds, Science Publishing Limited.

AGF/SEC/T/250 : Chromatography

Total Credits :01 | Total Contact Hours : 15 Hrs | Maximum Marks :50

Learning Objectives of the Course:

- To provide the knowledge about experimental techniques of paper and thin layer chromatography
- To provide the knowledge of applications of Paper and Thin Layer chromatography in agriculture.
- To inculcate the skill of paper and thin layer chromatography.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the actual experimental techniques of paper and thin layer Chromatography.

CO 2: Analyse thefood stuffs and confirm the purity of organic compounds by TLC

CO 3: Separate the cations and anions by paper chromatography.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Chromatography:** Introduction of chromatography, principle of chromatography, application, types of chromatography.	**05 Hrs**
II	**Paper Chromatography:** Iintroduction, theory, technics of paper chromatography, precaution in paper chromatography, application paper chromatography.	**05 Hrs**
III	**Thin layer Chromatography:** Introduction, theory of TLC, technique of TLC, types of TLC, application of TLC.	**05 Hrs**

Text Books:

1. Advances in Chromatography by S.B. Bagade, M.R. Tajne, S.B. Gokhale
2. Principle Instrumental Analysis by Skoog, Holler, Crouch
3. Instrumental Methods of Chemicals Analysis by H. Kaur
4. Instrumental Methods of Chemicals Analysis by Chatwal and Anand
5. Chromatography by Elsa Lundanes, Leon Reubset, TygeGreibrokk

AGF/SEC/T/251 : Biofertilizers

Total Credits :01 Total Contact Hours : 15 Hrs Maximum Marks :50

Learning Objectives of the Course:

- The concept of bio-fertilizers and develop the skills for handling microbial inoculants.
- The growth and multiplication conditions of useful microbes and their role in mineral cycling and nutrition to plants.
- Various methods of decomposition of biodegradable waste and their conversion to compost.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Contribute to the development of sustainable agricultural practices.

CO 2: Promote the use of biofertilizers among farmers.

CO 3: Become biofertilizer entrepreneurs.

CO 4: Work in research and development or industry related to biofertilizers.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Biofertilizers:** Definition, introduction, status, different sources and importance, role of biofertilizers in sustainable agriculture, classification and composition of biofertilizers, Nitrogen fixation.	**05 Hrs**
II	**Types of Biofertilizer:** Biofertilizertypes, commercial history, introduction to important biofertilizers such as rhizobium, azotobacter, azospirillum, cyanobacteria, azolla, beijerinckia, PSM, AM fungi, silicate solubilizing bacteria (SSB).	**05 Hrs**
III	**MycorrhizalBiofertilizers**: Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, massinoculum production of VAM, field applications of Ectomycorrhizae and VAM.	**05 Hrs**

Text Books:

1. Somani, L.L. (2004). Handbook of Biofertilizers. Agrotech Publishing Academy, Udaipur
2. Sharma, A. K. (2005). A Hand Book of organic farming. Agrobios, Jodhpur, India, Rajasthan
3. Vayas, S.C., Vayas, S. and Modi, H.A. (1998). Biofertilizers and Organic Farming. AktaPrakashanNadiad.
4. Trueman'sBiofertilizers. (2018). Trueman Book Company, Jalandhar.
5. Biofertizer and biocontrol agents for agriculture;; by AM Pirttila .2021 4.
6. Biofertilizers for Sustainable Agriculture and Environment;; by BhoopanderGiri Ram Prasad, Qiang-Sheng Wu, AjitVarma;2019.

AGF/SEC/P/276 : Practical's on Chromatography

Total Credits :01 Total Contact Hours : 30 Hrs Maximum Marks :50

Learning Objectives of the Course:

- To provide the knowledge about experimental techniques of paper and thin layer chromatography
- To provide the knowledge of applications of Paper and Thin Layer chromatography in agriculture.
- To inculcate the skill of paper and thin layer chromatography.

Course Outcomes (COs) : After completion of the course, students will be able to -

CO 1: Understand the actual experimental techniques of paper and thin layer chromatography.

CO 2: Analyse the food stuffs and confirm the purity of organic compounds by TLC

CO 3: Separate the cations and anions by paper chromatography.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. To separate cation of group first (Pb^{2+}, Ag^{2+} Hg_2^{2+},) by paper chromatography 2. To separate anions F^-, Cl^-, Br^-, I^- by paper chromatography 3. To check the purity of organic compounds by paperchromatography.	**10Hrs**
II	4. To separate carbohydrates by TLC technics (fructose, glucose) 5. To separate ink pigment in red ink, blue ink and black ink 6. Analysis of food stuffs by TLC (i.e. Milk, fruit, potatoes, orange juice).	**10Hrs**
III	7. To check the purity of organic compounds by TLC. 8. To calculate R_f values and separation of given amino acids by TLC. 9. To calculate $R_f$values and separation of given organic compounds by TLC.	**10Hrs**

Text Books:

1. Advances in Chromatography by S.B. Bagade, M.R. Tajne, S.B. Gokhale
2. Principle Instrumental Analysis by Skoog, Holler, Crouch
3. Instrumental Methods of Chemicals Analysis by H. Kaur
4. Instrumental Methods of Chemicals Analysis by Chatwal and Anand
5. Chromatography by Elsa Lundanes, Leon Reubset, TygeGreibrokk.

AGF/SEC/P/277 : Practical's on Biofertilizers

Total Credits :01 | Total Contact Hours : 30 Hrs | Maximum Marks :50

Learning Objectives of the Course:

- To provide the practical knowledge of biofertilizers.
- To know about preparation of vermicompost and isolations of bacteria.
- To provide the knowledge about media for fungai and bacteria.

Course Outcomes (COs) : After completion of the course, students will be able to -

COs1: Understand the basic practical knowledge of biofertilizers.
COs2: Identify the importance of biofertilizers in crop cultivation.
COs3: Understand the preparation of media, isolations of bacteria and sterilization.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	1. Sterilization of glassware, culture media, other substances, materials and equipment. 2. Preparation of media for fungi and bacteria (PDA and Richards medium). 3. Isolation and culturing of Rhizobium from root nodules of leguminous crops. 4. Isolation of azatobacter from soil samples.	**10 Hrs**
II	5. Collection of Cyanobacteria and Azolla from rice fields. 6. Preparation of media for microbial biofertilizers: Yeast extract mannitol medium (YEMA), 7. Frankia broth, Burk's medium, azospirillum media 8. Isolation of azotobacter from root nodules of leguminous crops.	**10 Hrs**
III	9. Study of different Ectomycorrhizae using prepared slides. 10. Study of different types of Cyanobacteria used for nitrogen fixation. 11. Gram staining of bacteria. 12. Raising of legume seedlings with rhizobium treatment 13. Preparation of vermicompost. 14. Visit to commercial bio control units and Krishiseva Kendra.	**10 Hrs**

Text Books:

1. Dr.P. Hyma, Biofertilizers: Commercial Production Technology & Quality Control, 2017
2. S.Kaniyan, K.Kumar and K. Govindarajan, BiofertilizersTechnology, 2010,
3. Arun K Sharma. Biofertilizers for Sustainable Agriculture, 2017; Publishers Pvt. Ltd., New Delhi.