SAVITRIBAI PHULE PUNE UNIVERSITY

(Formerly University of Pune)

Four Year B.Sc. Degree Program in Wine, Brewing and Alcohol Technology

(Faculty of Science and Technology)

Choice-Based Credit System Syllabus NEP 2020 (2024 Pattern)

(As Per NEP 2020)

First Year B. Sc

To be implemented from Academic Year 2024-2025

Prepared by: B.O.S. MICROBIOLOGY, SPPU

Recommended by: Faculty, Science and Technology

Approved by: Academic Council, SPPU

(For Colleges Affiliated to Savitribai Phule Pune University, Pune)

Title of the Program: B.Sc. (Wine, Brewing and Alcohol Technology)

Preamble:

A preamble for a course in Wine, Brewing, and Alcohol Technology serves as an introduction that outlines the overarching objectives, goals, and the significance of the course. It sets the tone for the educational journey ahead, providing students with a clear understanding of what they can expect to gain from the program.

Introduction:

Welcome to the immersive and dynamic world of Wine, Brewing, and Alcohol Technology! This course is designed to be a captivating exploration into the art and science behind the production of wines, beers, and various alcoholic beverages. It aims to provide you with a comprehensive understanding of the entire spectrum of processes involved, from raw ingredients to the final, meticulously crafted libation.

Objectives to be achieved:

The primary objective of this course is to equip you with the knowledge and skills necessary to navigate the intricate realms of viticulture, brewing, and alcohol technology. Through a blend of theoretical insights and hands-on experiences, you will delve into the nuances of grape cultivation, fermentation, distillation, and the myriad techniques that transform humble ingredients into exquisite beverages.

Scopes of the course:

In a world where the appreciation for fine wines, craft beers, and spirits is continuously evolving, this course offers a panoramic view of the industry. From the vineyards to the breweries and distilleries, you will explore the science, technology, and craftsmanship that contribute to the diversity and richness of alcoholic beverages.

Key Themes:

- **Viticulture:** Understanding grape varieties, cultivation practices, and the terroir effect on wine.
- **Brewing:** Exploring the alchemy of transforming grains, hops, and yeast into unique and flavorful beers.
- **Distillation:** Unraveling the intricacies of distillation processes for the creation of spirits and liquors.
- **Quality Control:** Developing skills in sensory evaluation, tasting, and ensuring consistency in production.
- **Sustainability:** Embracing eco-friendly practices in the production of alcoholic beverages.
- **Market Trends:** Analyzing consumer preferences, emerging trends, and the business aspects of the industry.

Embark on a journey where tradition meets innovation, science intertwines with artistry, and the world of Wine, Brewing, and Alcohol Technology unfolds before you. By the end of this course, you will not only possess a profound knowledge of the subject but also be prepared to contribute to and thrive in the dynamic landscape of the beverage industry. Cheers to the exploration of flavors, aromas, and the boundless possibilities within the world of beverages!

This preamble aims to inspire students and convey the excitement and breadth of the course in Wine, Brewing, and Alcohol Technology.

Eligibility for Admission:

First Year B.Sc.:

Candidates applying for B.Sc. for wine technology should be H.S.C. in science disciplines OR 10 +2 years diploma course in Agriculture or Diploma in Fruit Processing and Wine

Technology or Horticulture.

Admissions will be given as per the selection procedure / policies adopted by the respective college

keeping in accordance with conditions laid down by the University of Pune.

Reservation and relaxation will be as per the Government rules.

Medium of Instruction: English

Board of Studies (BoS) in Microbiology

From 2023-24 to 27-28

Sr. No.	Name	Designation
1.	Dr. Pawar Sunil Trimbak	Chairman
2.	Dr. Pardesi Karishma Rajendra	Member
3.	Dr. Pabale Anupama Ashok	Member
4.	Dr. Wagh Pratima Pandit	Member
5.	Dr. Abhyankar Pragati Sunil	Member
6	Dr. Pathak Leena Pradeep	Member
7	Dr. Kulkarni Snehal V.	Member
8.	Dr. Kale Avinash Sudhakar	Member
9.	Dr. Marathe Rajendra Jagannath	Member
10.	Dr. Puranik Pravin R.	Member
11	Dr. Rajwade Jyotika Milind	Member
12.	Dr.Mali Gajanan Vishnu	Member
13	Dr. Shete Ashiwini Monish	Member
14	Dr. Patil Hemant jagatrao	Member

Semester/Level	Course Type	Course Code	Theory/Practical	Title/Course Name	Credits
SEM-I/4.5	Subject-1	WT-101 T	Theory	Basic Microbiology-I	2
	Subject-1	WT-101 P	Practical	Laboratory techniques in Microbiology-I	2
	Subject-2	WT-102T	Theory	Basic Biochemistry-I	2
	Subject-2	WT-102 P	Practical	Laboratory techniques in Biochemistry-I	2
	Subject-3	WT-103 T	Theory	Basics of Wine technology-I	2
	Subject-3	WT-103 P	Practical	Laboratory techniques in Wine technology-I	2
	Open Elective	OE-101 WT	Theory	Vine to wine	2
	Skill Enhancement Course	SECP-101 WT	Practical	Handling and maintenance of equipments in alcohol production	2
	Indian Knowledge System	WT-101 IKS	Theory	IKS Generic	2
	Ability enhancement course	AEC-101-WT	Theory	English/Hindi/Marathi	2
	Value education Course	VEC-101-WT	Theory	Environmental Science	2
					Total (22)
SEM-II/4.5	Subject-1	WT-151 T	Theory	Basic Microbiology-II	2
	Subject-1	WT-151 P	Practical	Laboratory techniques in Microbiology-II	2
	Subject-2	WT-152T	Theory	Basic Biochemistry-II	2
	Subject-2	WT-152 P	Practical	Laboratory techniques in Biochemistry-II	2
	Subject-3	WT-153T	Theory	Basics of beer and alcohol technology	2
	Subject-3	WT-153 P	Practical	Laboratory techniques of beer and alcohol technology	2
	Open Elective	OEP-151 WT	Practical	Laboratory techniques in vine to wine	2
	Skill Enhancement Course	SECP-151 WT	Practical	Experiments in fruit processing	2
	Ability enhancement course	AEC-151-WT	Theory	English/Hindi/Marathi	2

	Value education Course	**VEC-151-WT**	**Theory**	**Environmental Science**	**2**
	Certificate course	**CC-151-WT**	**-**	**PE/NSS/NCC**	**2**
					Total (22)

Credit framework for First Year (UG)

Exit options, Award of credits, Evaluation pattern and ATKT rules are as per the SPPU

External Students

There shall be no external students.

University Terms

Dates for the commencement and the conclusion of the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on a minimum of 80 percent attendance at theory and practical courses and satisfactory performance during the term.

Current curriculum orientation

To accommodate more advanced topics in the syllabi, it is necessary to understand the basic science knowledge level of the students who have chosen the Wine, Brewing & Alcohol Technology discipline. Curricula of courses of state and central boards of higher secondary level were reviewed to avoid reiterations of previous syllabi.

Semester I

Subject-1

WT-101-T - Basic Microbiology-I

Total: 2 Credits Work-load: -15hrs/credit
(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives	
1	Students should be able to differentiate among bacteria, viruses, fungi, and protozoa, and categorize them based on key characteristics.
2	Understand the morphology and structure of microorganisms and how their structures relate to their functions.
3	Explore the interactions between different microorganisms, including symbiotic relationships and competition.
4	Assess the role of microorganisms in various ecosystems and their impact on environmental processes.
5	Trace the historical development of microbiology and its contributions to scientific understanding and medical advancements.

	Course Outcomes (COs) On completion of the course, the students will be able to:
CO1	Identify and classify different types of microorganisms, including bacteria, viruses, fungi, and protozoa.
CO2	Describe the structure and function of microorganisms.
CO3	Explain the factors affecting microbial growth.
CO4	Understand the roles of microorganisms in various ecological processes.
CO5	Develop basic microbiological laboratory skills, including aseptic techniques, staining procedures, and culture methods.
CO6	Effectively communicate microbiological concepts both orally and in writing.

Credit no.	Unit/ topic details	No. of hours
I	**Unit-l : Introduction to Microbiology** **1.1 History of Microbiology & Introduction to Microscopy** • Scope of Microbiology • Contribution of Scientists in the field of Microbiology • Principle & Working of Dark Field, Bright Field Microscopy **1.2 Classification of Microorganisms** • Classification of Micro-organisms as per Whittaker (5 Kingdom Classification) **1.3 Staining Techniques** • Definition of stain, types of stain (acidic &basic) • Properties and role of fixative, mordant & decolourizer • Staining's-Monochrome Staining, Negative Staining & Gram's Staining	**4** **2** **3**
	Unit-lI: Microbial Physiology & growth: **2.1 Cell Biology** • Bacterial cytology • Morphology, Taxonomy, Isolation & Identification of Yeast **2.2 Microbial Growth** • Growth curve • Measurement of Bacterial Growth-Microscopic Methods & Standard Plate Count	**3** **3**
II	**Unit-lII : Industrial Microbiology** 3.1 Definition & Importance of Industrial Microbiology • Types of fermentation (Batch, Continuous, Dual) • Working & Construction of typical fermenter • Types of fermenter **3.2 Sterilization & Disinfection techniques** • Sterilization by heat – use of dry & moist heat	**4** **4**

	• Sterilization by radiation & filtration • Disinfectant types, action & applications **3.3 Nutrition of Microorganisms** • Nutritional requirements of micro-organisms (Bacteria & Fungi) • Types of culture media & ingredients of media **3.4 Methods of Preservation of Microbial cultures** • Methods of preservation of pure culture	**4** **3**

References:

1. Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint
2. Patel A. H. (2005) Industrial Microbiology.
3. Michael J. Pelzer, E.E.S. Chan, Noel R. Krieg (1993) Microbiology
4. P. Gunasekaran (2005) Laboratory Manual in Microbiology
5. Lansing M. Prescott John P. Harley & Donald A. Klein (2005) Microbiology
6. Rojer A. Stanier (1989) General Microbiology
7. Pawar C. B. & H. F. Daginawala (1982) General Microbiology Vol.-2
8. Stanbury, P. F., Whitaker A. & Hall S. T. (2008) Principles of Fermentation Technology
9. Panda U. N. (2005) Handbook of Microbiology and parasitology Anuradha De. (2009) Practical and applied microbiology
10. Atlas R. M. (1988, Digitized 2010). Experimental Microbiology: Fundamentals and Applications. United States: Macmillan.
11. Bergey's Manual of Systematic Bacteriology. (2005). Volume Two: The Proteobacteria, Part A: Introductory Essays. Garrity G. editor. Springer. ISBN 978-0- 387-24143-2.
12. Bergey's Manual of Systematic Bacteriology. (2005). Volume Two: The Proteobacteria, Part B: The Gamma proteobacteria. Garrity G. Brenner D. J., Krieg N. R., and Staley J. R. (Eds.). Springer. ISBN978-0-387-24144-9
13. Bergey's Manual of Systematic Bacteriology. (2005). Volume Two: The Proteobacteria, Part C: The Proteobacteria. Garrity G. Brenner D. J., Krieg N. R., and Staley J. R. (Eds.). Springer. ISBN978-0-387-24145-6

14. Bergey's Manual of Systematic Bacteriology. (2009). Volume Three: The Firmicutes. Part C: The Proteobacteria. Vos, P., Garrity, G., Jones, D., Krieg, N.R., Ludwig, W., Rainey, F.A., Schleifer, K.-H., Whitman, W. (Eds.). Springer. ISBN978-0-387-95041-9
15. Berry A. And Watson J. D. (2009). DNA: The Secret of Life. United States: Knopf Doubleday Publishing Group.
16. Bisen P.S. and Varma K. (2009). Handbook of Microbiology. CBS Publishers and Distributors, New Delhi, India.
17. Biswas S. B. and Biswas A. (2006) Introduction to viruses. Vikas Publishing House Private Limited, New Delhi, India
18. Dubey R. C. and D. K. Maheshwary. (2012). A textbook of Microbiology. S Chand and Company. New Delhi, India Kapoor K. K., Tauro P. and Yadav K. S. (2016). An Introduction to Microbiology. New Age International (P) Limited, New Delhi, India.
19. Klein D. A., Harley J. P. And Prescott L. (2001). Microbiology. United Kingdom: McGraw-Hill HigherEducation.
20. Luria S. (2018). General Virology. Creative Media Partners, LLC.USA
21. Miller A. D. and Tanner J. (2013). Essentials of Chemical Biology: Structure and Dynamics of Biological Macromolecules. Germany:Wiley.
22. Parasher Y. K. (2006). Modern Microbiology. Campus Books International, New Delhi, India.
23. Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). Microbiology: An Application based Approach. McGraw-Hill Education (India) Private Limited, New Delhi, India.

Semester I
Subject-1
WT-101-P: Laboratory techniques in Microbiology I

Total: 2 Credits Work-load: -15hrs/credit
(Total Workload:2 credits × 15 hrs =30×2=60 hrs in semester)

Course Objectives	
1	Demonstrate a strong awareness of laboratory safety protocols and adhere to safe practices when handling chemicals and biological materials.
2	Develop proficiency in maintaining aseptic conditions during laboratory work to ensure the purity of microbial cultures.
3	Master various methods for microbial culture, including streaking, pouring agar plates, and sub culturing.
4	Learn to operate light microscopes and perform microscopic examinations to observe different types of microorganisms.
5	Understand and execute staining techniques, including Gram staining, monochrome staining

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Demonstrate proficiency in aseptic techniques for handling microorganisms to prevent contamination.
CO2	Learn and apply various methods for culturing microorganisms, including agar plate streaking, broth cultures, and microbial isolation techniques.
CO3	Master the use of light microscopes and other microscopy techniques for observing microorganisms.
CO4	Perform staining techniques such as Gram staining to differentiate bacterial types.
CO5	Demonstrate awareness of laboratory safety protocols and practice safe handling of chemicals and biological materials.

1 Practical credit = 30 hours	**1 Practical = 4.00 hours**

Expt.No.	Title	No. of Practical
1	Study of different glassware & equipments used in Microbiology Laboratory.	**2**
2	Learning basic techniques in Microbiology: Wrapping of glassware, Cotton plugging, cleaning and washing of glassware, Inoculation of bacterial culture, biological waste disposal.	**2**
3	Study of microscope-compound microscope and its parts	**1**
4	I. Staining of Bacteria: a) Monochrome Staining b) Negative Staining c) Gram Staining II.Staining of Fungi by using various stains	**4**
5	Hanging drop preparation for observation of motility	**1**
6	Preparation of liquid medium -nutrients broth, Sabouraud broth and PDB	**1**
7	Preparation of nutrient agar medium, agar slant, SDA and PDA	**2**
8	Aseptic transfer techniques (slant to slant, broth to broth, broth to agar and Agar to Agar)	**1**
9	Wet Mount slide preparation and its observation – Fungi	**1**
	Total	**15**

References:

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology And Biotechnology. New Age International, New Delhi, India
2. Smith H. and Brown A. (2023). Benson's Microbiological Applications, Laboratory Manual,15th Edition. McGraw Hill.
3. Cappuccino J. G. and Welsh C. T. (2016). Microbiology: A Laboratory Manual. Pearson Education
4. Deshmukh A. M. (2007). Handbook of Media Stains Reagents Microbiology. Oxford Book Company
5. Garratt D. C. (2012). The Quantitative Analysis of Drugs: 3rd Edition. United Kingdom: Springer US.

Semester I
Subject-2
WT-102-T: Basic Biochemistry-I

Total: 2 Credits Workload:15hrs/credit
(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives	
1	Identify and describe the structure of major biomolecules, including proteins, nucleic acids, lipids, and carbohydrates.
2	Explore the levels of protein structure and understand how it relates to protein function.
3	Explore the pathways of carbohydrate metabolism, including glycolysis and citric acid cycle.
4	Examine the metabolism of amino acids, including their synthesis and degradation.
5	Understand the process of protein folding and the consequences of protein.
6	Understand the biochemical basis of nutrition including vitamins

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Identify and describe the structure of major biomolecules, including proteins, nucleic acids, lipids, and carbohydrates.
CO2	Explore the levels of protein structure and understand the relationship between structure and function in proteins.
CO3	Explore the principles of metabolism, including catabolic and anabolic pathways, and the role of ATP as an energy currency.
CO4	Understand the metabolism of amino acids, including their anabolism and catabolism.
CO5	Understand the structure and function of biological membranes

Credit no.	Unit/ topic details	No. of hours
I	**Unit-I: Introduction and fundamentals of Biochemistry** 1.1: Structure and properties of water, hydrogen bonding, ionization of water, interaction of biological molecules in water, osmosis. 1.2: Concept of pH and buffers, biological buffers-concept, types and their importance 1.3 Types of bonds, Covalent and non-covalent interactions in biomolecules with suitable examples	**7**
	Unit-II: Biomolecules 2.1 Concept of biomolecules 2.2: Carbohydrates-Classification, properties and functions 2.3: Proteins- Classification, properties and functions, Basic structure and classification of amino-acids 2.4: Water soluble vitamins - Classification, properties and functions.	**8**
II	**Unit-III: Bioenergetics and metabolic pathways** 3.1: Concept of bioenergetics, concept of free energy, Laws of thermodynamics and their relevance to metabolism 3.2: Concepts of Metabolism- catabolism, anabolism, fermentation & cellular respiration 3.3: Metabolic pathways- Glycolysis (EMP) and fates of pyruvate, TCA cycle	**15**

References:

1. .Keith Wilson (2005) Practical Biochemistry Biology Principles & Techniques
2. Deb A. C. (1999) Concepts of biochemistry (Theory & Practical)
3. Leininger Albert L. (1984) Principles of Biochemistry
4. David L. Nelson & Michael M. (2005) Leininger, Principles of Biochemistry
5. Sadasivam S. & Manickam A. (2010) Biochemical Methods
6. Gurdeep P. Chaiwal & Sham K. Anand (2007) Industrial methods of chemical Analysis
7. Deb A. C. (2004) Fundamentals of biochemistry

Semester I
Subject-2
WT-102-P: Laboratory techniques in Biochemistry I

Total: 2 Credits Work-load: -15hrs/credit
(Total Workload:2 credits × 15 hrs =30×2=60 hrs in semester)

Course Objectives	
1	Demonstrate a strong awareness of laboratory safety protocols and adhere to safe practices when handling chemicals and biological materials.
2	Develop proficiency in maintaining aseptic conditions during laboratory work to ensure the purity of microbial cultures.
3	Master various methods for microbial culture, including streaking, pouring agar plates, and sub culturing.
4	Learn to operate light microscopes and perform microscopic examinations to observe different types of microorganisms.
5	Understand and execute staining techniques, including Gram staining, monochrome staining

Course Outcomes (COs) **On completion of the course, the students will be able to:**	
CO1	Demonstrate proficiency in aseptic techniques for handling microorganisms to prevent contamination.
CO2	Learn and apply various methods for culturing microorganisms, including agar plate streaking, broth cultures, and microbial isolation techniques.
CO3	Master the use of light microscopes and other microscopy techniques for observing microorganisms.
CO4	Perform staining techniques such as Gram staining to differentiate bacterial types.
CO5	Demonstrate awareness of laboratory safety protocols and practice safe handling of chemicals and biological materials.

1 Practical credit = 30 hours	**1 Practical = 4.00 hours**

Expt. No.	Title	No. of Practical
1	Safety Measures and practices in biochemistry laboratory	**1**
2	Molarity, molality, normality, ppm, ppb.	**1**
3	Laboratory Equipment's: Working Principle and Handling a) Distillation unit b) Colorimeter & spectrophotometer c) pH meter d) Balance e) Centrifuge	**1**
4	Preparation of Buffers – Acetate buffer and phosphate buffer	**1**
5	pH measurement- Use of pH indicator and pH meter	**1**
6	Determination of alkalinity of water	**1**
7	Titration - a) Strong acid with the strong base. b) Weak acid with strong base.	**2**
8	Determination of Ascorbic acid	**3**
9	Estimation of reducing sugar by DNSA method	**1**
10	Paper chromatography of sugar	**1**
11	TLC of amino acids/ Sugars	**1**
12	Determination of ƛ max	**1**
	Total	**15**

References:

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology And Biotechnology. New Age International, New Delhi, India
2. Smith H. and Brown A. (2023). Benson's Microbiological Applications, Laboratory Manual,15th Edition. McGraw Hill.
3. Cappuccino J. G. and Welsh C. T. (2016). Microbiology: A Laboratory Manual. Pearson Education
4. Deshmukh A. M. (2007). Handbook of Media Stains Reagents Microbiology. Oxford Book Company
5. Garratt D. C. (2012). The Quantitative Analysis of Drugs: 3rd Edition. United Kingdom: Springer US.

Semester -I

WT-103-T: Basics of wine technology-I

Total: 2 Credits Workload:15hrs/credit
(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives	
1	Provide an overview of the winemaking process, including grape cultivation, harvesting, and the basic steps involved in fermentation.
2	Familiarize students with major grape varieties used in winemaking and the key wine-producing regions around the world.
3	Introduce basic principles of viticulture, covering grapevine anatomy, soil requirements, and climate considerations for grape cultivation.
4	Explore various harvesting techniques and factors influencing the timing of grape harvest for optimal wine quality.
5	Explain the processes of crushing and pressing grapes to extract juice, including the equipment used in these stages.
6	Cover the science behind fermentation, including the role of yeast, temperature control, and the conversion of sugars into alcohol.
7	Discuss different types of wine yeasts and microorganisms involved in fermentation, highlighting their impact on wine flavors and aromas.

Course Outcome After studying this course students will be able to	
1.	Students should demonstrate a comprehensive understanding of the key stages in the winemaking process, from grape cultivation to bottling.
2.	Ability to identify and describe major grape varieties used in winemaking and their characteristic flavors.
3.	Demonstrate competence in selecting and implementing appropriate grape harvesting techniques for optimal wine quality.
4.	Mastery of the scientific principles behind fermentation, including the role of yeast, temperature control, and the conversion of sugars into alcohol.

Credit	Unit/ topic details	Number of Hours
I	**Unit 1: Introduction to Wine Making:** 1.1 Definition and terminology in wine making 1.2 Common grape variety- Red and White grape varieties 1.3 Terroir- Concept of terroir and their importance 1.4 Chemical constituent of Grapes 1.5 Chemical constituent of wine and health benefits of wine	**6**
	Unit 2: Commercial aspects of wine production: 1.1 Traditional and commercial wine making practices 1.2 Raw material and equipment used in wine production press fermenter and additives used in wine 1.3 Pre-fermentation action (use of enzyme, skin contact and maturation)	**9**
II	**Unit 3: Wine production method** 3.1 Basics of wine production 3.2 Method of white wine production 3.3 Role of Sulphur dioxide in wine production	**5**
	Unit 4: Introduction to Sensory evaluation of Wine: 4.1 Sensory evaluation and terminology 4.2 Basic taste of wine (bitterness, acidity, salt, sweetness and alcohol on tongue) 4.3 Neuro-physiological mechanism of tasting 4.4 Selection and different types of glass and serving temperature of wines 4.5 Concept of wine clarity	**10**

References:

1.Ronald S. Jackson (2002) Wine Testing a professional handbook

2. Ron s. Jockson (2000) Wine science principles practices & perception

3. Vine, Richard p (1997) Wine Appreciation

4.Emile Peynavd (1997) The taste of wine

5.Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and

production

6. C. S. Ough (1992) Wine making Basics

7. Roger B.Boulton (1996) Principles and practices of wine making

8.Emile Peynalld (1984) Knowing & making wine

Semester -I

WT -103-P: Laboratory techniques in wine technology-I

Total: 2 Credits Workload:30hrs/credit

(Total Workload:2 credits × 30hrs =60 hrs in semester) **1 Practical = 4.00 hours**

Course Objectives	
1	Train students in advanced sensory evaluation techniques to identify and analyze complex flavors, aromas, and characteristics of alcoholic beverages.
2	Explore and understand advanced techniques in brewing, distillation, and winemaking, delving into specific methods for enhancing flavors, aromas, and overall quality.
3	Develop skills in implementing stringent quality control measures, including sensory analysis, chemical testing, and microbiological evaluation to ensure high-quality alcoholic beverages.
4	Teach students how to optimize brewing, distillation, and winemaking processes by employing advanced technological methods, improving efficiency, and maintaining consistency in production.

Course Outcome After Completion of this course students will be able to	
CO1	Demonstrate advanced knowledge and practical skills in specialized production techniques for wine, beer, and various alcoholic beverages.
CO2	Apply advanced methods to optimize brewing, distillation, and winemaking processes, incorporating innovative techniques to enhance product quality and efficiency.
CO3	Implement stringent quality control measures, advanced sensory analysis, and chemical testing methods to ensure consistent and superior quality in alcoholic beverages.
CO4	Showcase an in-depth understanding of microbial interactions, fermentation processes, and advanced yeast management techniques to influence flavor profiles and product consistency.
CO5	Demonstrate advanced knowledge of complex regulations governing alcoholic beverage production, ensuring adherence to legal and industry standards.

Expt No.	Topics	No. of Practical
1	Identification of grape and wine varieties	2
2	A small survey on “Wine as an alcoholic drink”: Report writing.	2
3	To study threshold detection of acid taste.	1
4	To study threshold detection of sweet taste.	1
5	To study threshold detection of bitter taste	1
6	To study threshold detection of bitter taste.	1
7	Study of aroma wheel.	1
8	Types of wine glasses	1
9	Study of a 50 KL winery.	1
10	Interaction of sweet and acid taste.	1
11	Interaction of sweet, acid and bitter taste	1
12	Effect of the serving temperature on wines	1
13	Identification of off odors in wine.	1
	Total	**15**

References:

1.Ronald S. Jackson (2002) Wine Testing a professional handbook
2.Ron s. Jockson (2000) Wine science principles practices & perception
3.Vine, Richard p (1997) Wine Appreciation
4.Emile Peynavd (1997) The taste of wine
5.Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and production
6.C. S. Ough (1992) Wine making Basics
7.Roger B.Boulton (1996) Principles and practices of wine making
8.Emile Peynalld (1984) Knowing & making wine
9.Patrice Iland & Peter Gago (1997) Australian wine from the grasp vine to the glass

Semester I

OE-101- WT: Vine to wine

Open Elective

Total: 2 Credits Workload:15hrs/credit

(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives This course is designed for students from non-wine technology background	
1	Understand the fundamentals of grapevine cultivation, including site selection, planting, and vineyard management.
2	Understand the role of soil composition and health in grapevine cultivation, and its influence on grape quality.
3	Learn about the various techniques for pressing grapes and extracting juice, including the use of different types of presses.
4	Understand the science behind fermentation and different fermentation methods, including yeast selection and temperature control.
5	Learn techniques for wine filtration, stabilization, and the prevention of common wine faults.

Course Outcomes After studying this course students will be able to	
CO1	Students should demonstrate a thorough understanding of viticulture, including the cultivation of grapevines, soil management, and the impact of climate and terroir on grape quality.
CO2	Students should be able to identify and describe various grape varieties, understanding their unique characteristics and how they contribute to different wine styles.
CO3	Apply practical vineyard management practices, including optimize grape yield and quality.
CO4	Apply various techniques for pressing grapes and extracting juice, taking into consideration the impact on wine quality.
CO5	Apply methods for quality control, including sensory analysis and laboratory testing of wines.

Credit	Unit/ topic details	Number of Hours
I	**Unit 1: Introduction to wine technology** 1.1 Define - Wine 1.2 Classification of wine 1.3 Wine quality vintage & terroir 1.4 Wine and health (Resveratrol, French paradox) 1.5 Grape maturity	**7**
	Unit 2: Transformation of grapes into wine 2.1 Pre-fermentation action- enzymes & skin contact 2.2 Artificial inoculation of yeast 2.3 Alcoholic fermentation	**8**
II	**Unit 3: Wine fermentation technology** 3.1 White wine 3.2 Red wine 3.3 Rose wine 3.4 Sparkling wine	**8**
	Unit 4: Wine fermentation technology 4.1 Use of Sulphur dioxide & pH influence 4.2 Control of alcoholic fermentation 4.3 Clarification and stabilization- fining, filtration 4.4 Aging process in oak barrels 4.5 Work with barrels - stacking & maintenance	**7**

References:

1.Ronald S. Jackson (2002) Wine Testing a professional handbook

2.Ron s. Jockson (2000) Wine science principles practices & perception

3.Vine, Richard p (1997) Wine Appreciation

4.Emile Peynavd (1997) The taste of wine

5.Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and production

6.C. S. Ough (1992) Wine making Basics

7.Roger B.Boulton (1996) Principles and practices of wine making

8.Emile Peynalld (1984) Knowing & making wine

9.Patrice Iland & Peter Gago (1997) Australian wine from the grasp vine to the glass

Semester I

SECP-101- WT: Handling and maintenance of equipment's in alcohol production

Total: 2 Credits Work-load: -15hrs/credit

(Total Workload:2 credits × 15 hrs =30×2=60 hrs in semester) **1 Practical = 4.00 hours**

Course Objectives **This Course is designed to**	
1	Familiarize students with the various types of equipment used in alcohol production, including fermenters, distillation columns, refractometer, Hydrometer, ebulliometer, Spectrophotometer.
2	Develop a thorough understanding of the functions of each piece of equipment in the alcohol production process.
3	Teach the principles of distillation and guide students in operating distillation columns efficiently to separate alcohol from fermented mash.

Course Objectives After studying this topic students will be able to.	
CO1	Provide an overview of the various types of equipment used in alcohol production, including fermentation vessels, distillation columns, refractometer, Hydrometer, ebulliometer, Spectrophotometer.
CO2	Develop a detailed understanding of the functions and operational principles of key equipment involved in alcohol production.
CO3	Teach the principles of distillation and guide students in the safe and efficient operation of distillation columns for alcohol separation.
CO4	Introduce the use of centrifuges in alcohol production, covering operational procedures and maintenance requirements.

Practical No.	Experiment Title	No. of Practicals
1	Handling and maintenance of chemical balance	1
2	Handling and maintenance of colorimeter or spectrometer	1
3	Handling and maintenance of Refractometer	1
4	Handling and maintenance of ebulliometer	1
5	Handling and maintenance of hydrometer	1
6	Handling and maintenance of centrifuge	1
7	Handling and maintenance of distillation unit	1
8	Calibration of pH meter	1
9	Handling and maintenance of Autoclave	1
10	Handling and maintenance of microscope	1
11	Handling and maintenance of brewery unit	1
12	Handling and maintenance of winery unit	2
13	Handling of CIP unit in alcohol industry	2
	TOTAL	**15**

References:

1.The Alcohol Textbook –W.M. Inledew.

2. Handbook of Alcohol beverages - by Alan Buglass.

3. Handbook of Fermentation and Distillation–ACChatterjee.

4. Distillation Engineering handbook by Parthasarathi 31 Chattopadhyay

5. Malt whisky – by Charles MacLean

6. Distilled spirits production, technology, innovation–by J.H.Bryce,J.R.Piggott

7.A History of Beer & Brewing by Tan S. Harnesey.

8. Brewing engineering by Stevendeeds.

9. Brewing by Michel j. Lewis, tom W. Young

10. Water a comprehensive guide for brewers by Johnpalmer

11. Yeast the practical guide to beer fermentation by Chris white with Jamilzaianshef

Semester II
Subject-1
WT-151-T: Basic Microbiology-II

Total: 2 Credits Workload:15hrs/credit
(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives	
1	Students should be able to differentiate among bacteria, viruses, fungi, and protozoa, and categorize them based on key characteristics.
2	Understand the morphology and structure of microorganisms and how their structures relate to their functions.
3	Explore the interactions between different microorganisms, including symbiotic relationships and competition.
4	Assess the role of microorganisms in various ecosystems and their impact on environmental processes.
5	Trace the historical development of microbiology and its contributions to scientific understanding and medical advancements.
6	Students should be able to differentiate among bacteria, viruses, fungi, and protozoa, and categorize them based on key characteristics.

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Identify and classify different types of microorganisms, including bacteria, viruses, fungi, and protozoa.
CO2	Describe the structure and function of microorganisms.
CO3	Explain the factors affecting microbial growth.
CO4	Understand the roles of microorganisms in various ecological processes.
CO5	Develop basic microbiological laboratory skills, including aseptic techniques, staining procedures, and culture methods.
CO6	Effectively communicate microbiological concepts both orally and in writing.

I	**Unit-l: Introduction to Fermentation Technology** **1.1Fermentation Technology** • Historical development of Fermentation Technology • Scope of Fermentation Technology **1.2. Fermentation Media** • Components of typical fermentation medium. • Role of nutrients in microbial growth. • Crude sources of N & C. Antifoam agents. • Stock cultures and its maintenance. • Industrial microbiological products as Primary and secondary metabolites	**3** **12**
II	**Unit-lI: Fermentation Process** • Fermentation and its types. • Sterilisation of fermentation media. • Primary and secondary screening. • Strain improvement. • Inoculum preparation. • Culture collection centres and their objectives and working. • Upstream & downstream processing.	**15**

References:

1.Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint
2. Patel A. H. (2005) Industrial Microbiology.
3. Michael J. Pelzer, E.E.S. Chan, Noel R. Krieg (1993) Microbiology
4.P. Gunasekaran (2005) Laboratory Manual in Microbiology
5. Lansing M. Prescott John P. Harley & Donald A. Klein (2005) Microbiology
6. Rojer A. Stanier (1989) General Microbiology
7. Pawar C. B. & H. F. Daginawala (1982) General Microbiology Vol.-2
8. Stanbury, P. F., Whitaker A. & Hall S. T. (2008) Principles of Fermentation Technology
9. Panda U. N. (2005) Handbook of Microbiology and parasitology
10. Anuradha De. (2009) Practical and applied microbiology
11. Prescott Hurley Kline's (2008) Microbiology
12. Sathe S. T. Pharande S. R. (2010) Introduction to Microbiology

Semester II
Subject-1
WT-151-P: Laboratory techniques in Microbiology-II

Total: 2 Credits Work-load: -15hrs/credit
(Total Workload:2 credits × 15 hrs =30×2=60 hrs in semester)

Course Objectives	
1	Demonstrate a strong awareness of laboratory safety protocols and adhere to safe practices when handling chemicals and biological materials.
2	Develop proficiency in maintaining aseptic conditions during laboratory work to ensure the purity of microbial cultures.
3	Master various methods for microbial culture, including streaking, pouring agar plates, and sub culturing.
4	Learn to operate light microscopes and perform microscopic examinations to observe different types of microorganisms.
5	Understand and execute staining techniques, including Gram staining, monochrome staining

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Demonstrate proficiency in aseptic techniques for handling microorganisms to prevent contamination.
CO2	Learn and apply various methods for culturing microorganisms, including agar plate streaking, broth cultures, and microbial isolation techniques.
CO3	Master the use of light microscopes and other microscopy techniques for observing microorganisms.
CO4	Perform staining techniques such as Gram staining to differentiate bacterial types.
CO5	Demonstrate awareness of laboratory safety protocols and practice safe handling of chemicals and biological materials.

1 Practical credit = 30 hours	**1 Practical = 4.00 hours**

Expt.No.	Title	No. of Practicals
1	Isolation of bacteria and yeast from natural sources.	**2**
2	Study of effectiveness of hand washing	**1**
3	Observation of the growth of cultures and reporting of colony and cultur characteristics (Nutrient agar, Sabouraud's agar)	**3**
4	Isolation of Bacteria / Yeast by: a) Streak plate method. b) Pour plate method. c) Spread plate method.	**2**
5	Yeast for enumeration of yeast by Neubauer's chamber.	**1**
6	Preservation of cultures on slants	**1**
7	Effect of pH on bacterial Growth	**1**
8	Effect of salts on bacterial growth	**1**
9	Effect of Temperature on bacterial Growth	**1**
10	Inoculum development of yeast	**1**
11	Log sheet of fermentation and its graphical representation	**1**
	Total	**15**

References:

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology And Biotechnology. New Age International, New Delhi, India
2. Smith H. and Brown A. (2023). Benson's Microbiological Applications, Laboratory Manual,15th Edition. McGraw Hill.
3. Cappuccino J. G. and Welsh C. T. (2016). Microbiology: A Laboratory Manual. Pearson Education
4. Deshmukh A. M. (2007). Handbook of Media Stains Reagents Microbiology. Oxford Book Company
5. Garratt D. C. (2012). The Quantitative Analysis of Drugs: 3rd Edition. United Kingdom: Springer US

Semester II
Subject-2
WT-152-T: Basic Biochemistry-II

Total: 2 Credits Workload:15hrs/credit
(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives	
1	Identify and describe the structure of major biomolecules, including proteins, nucleic acids, lipids, and carbohydrates.
2	Explore the levels of protein structure and understand how it relates to protein function.
3	Explore the pathways of carbohydrate metabolism, including glycolysis and citric acid cycle.
4	Examine the metabolism of amino acids, including their synthesis and degradation.
5	Understand the process of protein folding and the consequences of protein.
6	Understand the biochemical basis of nutrition including vitamins

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Identify and describe the structure of major biomolecules, including proteins, nucleic acids, lipids, and carbohydrates.
CO2	Explore the levels of protein structure and understand the relationship between structure and function in proteins.
CO3	Explore the principles of metabolism, including catabolic and anabolic pathways, and the role of ATP as an energy currency.
CO4	Understand the metabolism of amino acids, including their anabolism and catabolism.
CO5	Understand the structure and function of biological membranes

Credit no.	Unit/ topic details	No. of hours
I	**Unit-I:** Lipids and Nucleic acids 1.1 Classification of lipids: Simple & complex lipids, fatty acids. **1.2** Structure, chemical and physical properties, **1.3** Complex lipids: Phospholipids and Glycolipids. **1.4** Function of lipids **1.5** Definition of Nucleic acids, General structure of DNA and RNA	**7**
	Unit-II: Enzymes and Vitamins 2.1 Enzymes-Definition, general properties, enzyme activation and inhibition 2.2 Models for enzyme catalysis. 2.3 Enzyme classification. 2.4 Fat soluble Vitamins: Classification, Biochemical functions.	**8**
II	**Unit-III: Metabolic pathways** 3.1: Protein metabolism: Transamination and oxidative deamination 3.2. Metabolic fates of amino acids 3.3 Urea cycle 3.4 Nucleic acid- Metabolism: Introduction to de novo & salvage synthesis 3.5 Metabolic Regulation a) Concept of homeostasis. b) Regulation at Enzyme level – feedback inhibition and its types.	**15**

References:

8. Keith Wilson (2005) Practical Biochemistry Biology Principles & Techniques
9. Deb A. C. (1999) Concepts of biochemistry (Theory & Practical)
10. Leininger Albert L. (1984) Principles of Biochemistry
11. David L. Nelson & Michael M. (2005) Leininger, Principles of Biochemistry
12. Sadasivam S. & Manickam A. (2010) Biochemical Methods
13. Gurdeep P. Chaiwal & Sham K. Anand (2007) Industrial methods of chemical Analysis
14. Deb A. C. (2004) Fundamentals of biochemistry

Semester II
Subject-2
WT-152-P: Laboratory techniques in Biochemistry-II

Total: 2 Credits Work-load: -15hrs/credit
(Total Workload:2 credits × 15 hrs =30×2=60 hrs in semester)

Course Objectives	
1	Demonstrate a strong awareness of laboratory safety protocols and adhere to safe practices when handling chemicals and biological materials.
2	Develop proficiency in maintaining aseptic conditions during laboratory work to ensure the purity of microbial cultures.
3	Master various methods for microbial culture, including streaking, pouring agar plates, and sub culturing.
4	Learn to operate light microscopes and perform microscopic examinations to observe different types of microorganisms.
5	Understand and execute staining techniques, including Gram staining, monochrome staining

Course Outcomes (COs) On completion of the course, the students will be able to:	
CO1	Demonstrate proficiency in aseptic techniques for handling microorganisms to prevent contamination.
CO2	Learn and apply various methods for culturing microorganisms, including agar plate streaking, broth cultures, and microbial isolation techniques.
CO3	Master the use of light microscopes and other microscopy techniques for observing microorganisms.
CO4	Perform staining techniques such as Gram staining to differentiate bacterial types.
CO5	Demonstrate awareness of laboratory safety protocols and practice safe handling of chemicals and biological materials.

1 Practical credit = 30 hours	**1 Practical = 4.00 hours**

Expt.No.	Title	No. of Practicals
1	Qualitative test for carbohydrate	**1**
2	Qualitative test for Lipid/ Proteins	**1**
3	pH measurement- Use of pH indicator	**1**
4	pH measurement- Use of pH meter	**1**
5	Total Carbohydrate estimation by phenol sulphuric acid method	**1**
6	Paper chromatography of amino acids.	**1**
7	Protein estimation- Folin Lowry method.	**1**
8	Protein estimation- Biuret method.	**1**
9	Enzyme assay (amylase)	**2**
10	Extraction of lipids in organic solvents. (chloroform, methanol)	**2**
11	Determination of chlorine content in water.	**1**
12	TLC of lipids, carbohydrates	**2**
	Total	**15**

References:

1.Keith Wilson (2005) Practical Biochemistry Biology Principles & Techniques
2. Deb A. C.(1999) Concepts of biochemistry (Theory & Practical)
3.Lehninger Albert L.(1984) Biochemistry
4.David L. Nelson & Michael M.(2005) Lehninger principles of Biochemistry
5.Sadasivam S. & Manickam A.(2010) Biochemical Methods
6.Gurdeep P.Chaiwal & sham K. Anand (2007) Industrial methods of chemical Analysis
7.Deb A. C.(2004) Fundamentals of biochemistry

Semester -II

WT -153-T: Basics of beer and alcohol technology

Total: 2 Credits Workload:15hrs/credit
(Total Workload:2 credits × 15 hrs =30 hrs in semester)

Course Objectives	
1	Introduce students to the fundamental principles of beer and alcohol production, covering key concepts in brewing science and technology.
2	Explore the ingredients used in beer and alcohol production, understanding their roles and interactions during the brewing/distillation process.
3	Teach the basic techniques involved in brewing beer or distilling alcohol, including mashing, fermentation and aging processes.
4	Familiarize students with quality control measures and techniques essential in ensuring the consistency and quality of the final product.
5	Provide hands-on experience or case studies to reinforce theoretical knowledge, allowing students to apply what they've learned in real or simulated settings.
6	Equip students with a foundational understanding that could serve as a stepping stone for further education or careers in the brewing/distillation industry.

Course Outcome After Studying this course students will be able to	
CO1	Demonstrate a comprehensive understanding of the basic principles, terminology, and key concepts related to beer and alcohol production.
CO2.	Identify and explain the role of different ingredients (e.g., grains, hops, yeast, and malt) and the processes involved in brewing beer and producing various types of alcoholic beverages.
CO3	Understand fundamental brewing techniques, including mashing, fermentation, aging, distillation, and bottling, for producing a range of alcoholic beverages.
CO4	Understanding of raw-material with respect to its selection and standardization.
CO5	Apply quality control measures to ensure consistency, purity, safety of beer and alcoholic products.
CO6	Comply with safety protocols and demonstrate an understanding of regulatory standards related to production, distribution and consumption of alcoholic beverages.

Credit	Topic	No. of Hours
I	**Unit-I Introduction to Brewing and Alcohol Technology:** 1.1: Introduction to beer and alcohol- beer and its types, alcohol and its types 1.2: Brewing: a) Ingredients –Water, Fermentable Carbohydrates, Hops, Yeast b) Processing- Equipment configuration and design Grain milling, Mashing, Lautering, Boiling — type and length. Temperature of fermentation. Time of maturation, Filtration etc. c) Culture 1.3: Distillery: a) Role of wine technologist in distillery-Scope & functions of technical person in distillery b) Process flow diagram of distillery c) Raw materials used in alcohol production- Sugar containing, Starch containing and cellulosic raw materials.	**2** **4** **4**
	Unit-II: Starter Culture-Yeast 2.1: Propagation practices of yeast adopted under plant conditions. Measurement of number of yeast cells/yeast count etc., Active Dry yeast 2.2: Yeast handling, Yeast pitching, Yeast removal	**5**
II	**Unit-III: Outline of Brewing and Distillery** 3.1: Outline of the Brewing Steps-Malts, Adjuncts ,brewing liquor, milling, mashing, Wort separation, Wort boiling, Trub removal, Wort cooling/aeration, Aging, Clarification, Packaging 3.2: Raw material used in distillery: Molasses- Molasses handling: a) Overview of Molasses composition, grades, storage and cost b) Molasses dilution practices adopted and design of diluter. c) Clarifications of molasses- advantages and drawback d) Molasses sterilization /pasteurization.	**8** **7**

References:

1.The Alcohol Textbook –W.M.Inledew.

2. Handbook of Alcohol beverages - by Alan Buglass.

3. Handbook of Fermentation and Distillation–A.C.Chatterjee.

4. Distillation Engineering handbook by Parthasarathi 31 chattopadhyay

5. Malt whisky – by Charles MacLean

6. Distiiled spirits production, technology, innovation–by J.H.Bryce,J.R.Piggott

7.A History of Beer & Brewing by Tan S. Harnesey.

8. Brewing engineering by Stevendeeds.

9. Brewing by Michel j. lewis, tom w.young

10. Water a comprehensive guide for brewers by Johnpalmer

11. Yeast the practical guide to beer fermentation by Chris white with Jamilzaiansheff

Semester -II

WT -153-P: Laboratory techniques of beer and alcohol technology

Total: 2 Credits Workload:30hrs/credit

(Total Workload:2 credits × 30hrs =60 hrs in semester) **1 Practical = 4.00 hours**

Course Objectives	
1	Train students in advanced sensory evaluation techniques to identify and analyze complex flavors, aromas, and characteristics of alcoholic beverages.
2	Explore and understand advanced techniques in brewing, distillation, and winemaking, delving into specific methods for enhancing flavors, aromas, and overall quality.
3	Develop skills in implementing stringent quality control measures, including sensory analysis, chemical testing, and microbiological evaluation to ensure high-quality alcoholic beverages.
4	Teach students how to optimize brewing, distillation, and winemaking processes by employing advanced technological methods, improving efficiency, and maintaining consistency in production.

Course Outcome After Completion of this course students will be able to	
CO1	Demonstrate advanced knowledge and practical skills in specialized production techniques for wine, beer, and various alcoholic beverages.
CO2	Apply advanced methods to optimize brewing, distillation, and winemaking processes, incorporating innovative techniques to enhance product quality and efficiency.
CO3	Implement stringent quality control measures, advanced sensory analysis, and chemical testing methods to ensure consistent and superior quality in alcoholic beverages.
CO4	Showcase an in-depth understanding of microbial interactions, fermentation processes, and advanced yeast management techniques to influence flavor profiles and product consistency.
CO5	Demonstrate advanced knowledge of complex regulations governing alcoholic beverage production, ensuring adherence to legal and industry standards.

Expt No.	Topics	No. of Practicals
1	Study of germination of Barley	1
2	Determination of specific gravity and extract of wort and molasses	2
3	Determination of reducing sugar content of wort and molasses	2
4	Determination of pH of wort and molasses	2
5	Determination of total and fix volatile acidity of wort and rectified spirit	2
6	Determination of volatile acidity of reducing sugar.	1
7	Determination the Brix, specific gravity of the wort and molasses.	2
8	Study of basic distillation practices	1
9	Industrial Visit to winery/brewery/distillery	2
	Total	**15**

References:

1.The Alcohol Textbook –W.M.Inledew.

2. Handbook of Alcohol beverages - by Alan Buglass.

3. Handbook of Fermentation and Distillation–A.C.Chatterjee.

4. Distillation Engineering handbook by Parthasarathi 31 chattopadhyay

5. Malt whisky – by Charles MacLean

6. Distiiled spirits production, technology, innovation–by J.H.Bryce,J.R.Piggott

7.A History of Beer & Brewing by Tan S. Harnesey.

8. Brewing engineering by Stevendeeds.

9. Brewing by Michel j. lewis, tom w.young

10. Water a comprehensive guide for brewers by Johnpalmer

11. Yeast the practical guide to beer fermentation by Chris white with Jamilzaiansheff

Semester I

OEP-151- WT: Laboratory techniques in vine to wine

Open Elective

Total: 2 Credits Workload:30hrs/credit
(Total Workload:2 credits × 30 hrs =60 hrs in a semester)**1 Practical = 4.00 hours**

Course Objectives	
1	Familiarize students with the basic principles and objectives of laboratory analysis in the context of winemaking.
2	Instruct students on proper techniques for collecting wine samples and preparing them for various laboratory analyses.
3	Teach methods for measuring and analyzing the acidity of wines, including titration techniques.
4	Instruct on the principles and methods of pH measurement in wines using appropriate instruments.
5	Teach methods for determining alcohol content in wines, such as distillation and hydrometer readings.

Course Outcomes After learning this course students will be able to	
CO1	Students should be proficient in collecting and preparing wine samples for various laboratory analyses, ensuring accuracy and representativeness.
CO2	Demonstrate a strong commitment to laboratory safety protocols and ethical considerations in handling chemicals, equipment, and data.
CO3	Conduct precise pH measurements in wines using appropriate instruments, understanding the significance of pH in winemaking.
CO4	Apply techniques for measuring sugar content in grapes and wines, utilizing methods such as refractometry.
CO5	Identify and analyse common yeast and bacterial strains associated with winemaking, demonstrating competence in microbial analysis.
CO6	Perform analyses related to wine stability, including protein and tartrate stability, ensuring the quality and longevity of wines.

Sr. No.	Practical Titles	Number of Hours
1	To study the morphology of yeast by wet mount preparation	**1**
2	To study the vital staining of yeast using methylene blue stain	**1**
3	Isolation of yeast by dilution plate method	**1**
4	Identify the basic test of wines	**2**
5	The Art of wine tasting	**2**
6	To observe budding of yeast cells	**1**
7	Determination of pH of wine & must	**1**
8	Determination of the titrable acidity of wine & must	**2**
9	Estimation of total soluble solids of juice- wine & must by Refractometer	**2**
10	Estimation of total soluble solids of grape juice- wine & must by Hydrometer	**2**
	Total	**15**

References:

1.Ronald S. Jackson (2002) Wine Testing a professional handbook

2.Ron s. Jockson (2000) Wine science principles practices & perception

3.Vine, Richard p (1997) Wine Appreciation

4.Emile Peynavd (1997) The taste of wine

5.Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and production

6.C. S. Ough (1992) Wine making Basics

7.Roger B.Boulton (1996) Principles and practices of wine making

8.Emile Peynalld (1984) Knowing & making wine

9.Patrice Iland & Peter Gago (1997) Australian wine from the grasp vine to the gl

Semester II

SECP-151- WT: Experiments in fruit processing

Open Elective

Total: 2 Credits Workload:30hrs/credit

(Total Workload:2 credits × 30 hrs =60 hrs in semester)**1 Practical = 4.00 hours**

Course Objectives	
1	Conduct practical experiments to demonstrate and reinforce the theoretical knowledge of various fruit processing techniques.
2	Enable students to design experiments aimed at optimizing processing parameters to enhance the quality, flavor, and nutritional value of processed fruit products.
3	Introduce principles of experimental design, statistical analysis, and interpretation of experimental data gathered during fruit processing trials to draw meaningful conclusions.
4	Provide practical training on operating various fruit processing equipment and machinery
5	Instruct students on proper experimental documentation, including recording observations, maintaining lab notebooks, and presenting findings through comprehensive reports.

Course Outcome After studying this course students will be able to	
CO1	Demonstrate hands-on proficiency in various fruit processing methods, including juicing, drying, canning, freezing, fermenting, and other experimental techniques.
CO2	Conduct experiments to assess and analyse the quality parameters of processed fruits.
CO3	Design and execute experiments to optimize processing parameters (time, temperature, additives, etc.) for enhancing the quality, flavour, and nutritional value of processed fruit products.
CO4	Experiment with different fruit combinations, additives, and novel processing methods to develop innovative and value-added fruit products, evaluating their sensory attributes and market potential.
CO5	Gain practical experience in operating fruit processing equipment, handling laboratory tools, and maintaining proper hygiene and safety practices during experiments.

Expt. no.	Title	No. of Practicals
1	Proximate composition of fruit juices a) pH by pH meter b) Acidity by titration c) Moisture content - oven drying	**2**
2	Extraction of fruit juices- a) Physical b) Mechanical c) Clarification	**3**
3	Procedure for preparation of jelly from any two fruits	**2**
4	Preparation of marmalade	**1**
5	Preparation and preservation of pomegranate juice	**1**
6	Preparation of lemon and sugar syrup	**1**
7	Preparation of vinegar from fruit juices	**1**
8	Preparation and preservation of jam from any two fruits	2
9	Determination of sugar content of various fruit juices	2
	Total	**15**

References:

1. Girdhari Lal, G.S. Siddappa & G.L. Tandon, Preservation of fruits and vegetables, first edition,1960, ICAR,New Delhi.
2. Sadasivam S. and Manickam A., Biochemical methods, First Edition 1996, New Age International Publisher
3. George Charalambous, St. Louis Missouri, Handbook of food & beverage stability, first edition,1986, Academic Press, INC., Harcourt Brace Javannovich, Publishers
4. Joshi.V.K.&Ashok Pandey, Biotechnology food fermentation, first edition,1999 Educational Publisher&Distibutors, New Delhi.
5. S. Ranganna, Handbook of analysis and quality control for fruit and vegetable products, First edition, 1979, Tata McGraw-Hill Publishing Company Limited New Delhi
6. Cruess W.V., Commercial Fruit and Vegetable products, First edition, 1958, McGraw-Hill Book Company Inc., New York
7. Cruess W.V., Homemade preparation of jelly & marmalade.1926, University of California, Agic Ext.Serv
8. Kertesz Z.I. The Pectic substances, First edition, 1951, Inter Science Publisher, inc., New York

9. Pruthi J.S., Processing of grape, Juice products & by-products 1971, Indian food packer.
10. G.Chatwal and Anand S., Instumental Methods of Chemical analysis, First edition, 1992, Himalaya Publishing House
11. Anonymous, Prevention of Food adulteration Act, 1954 with prevention of food adulteration rules, 1995, 20th edition, 2004, International Law Book Company.
12. Anonymous, Fruit products order,1995, 3rd edition, 2003, International Law Book Company.
13. Adel A. Kader, Post-Harvest Technology of Horticulture Crops, 2nd edition 1992, University of California, Division of Agriculture and Natural Resources.