

**Syllabus for
F. Y. B. Sc Wine Technology
University of Pune**

Submitted to BOS Microbiology

By

**Sathe S. J.
Chairman**

**Sub Committee for F. Y. B. Sc.
Wine Technology Syllabus**

B. Sc Wine Technology

SPECIAL FEATURES <ol style="list-style-type: none">1. More stress will be given to this process development and scale-up system along with marketing.2. Evaluation of waste for production of valuable products will be given prime importance3. Energy Production and Conservation will be considered during the tenure of the courses.4. Industry attached Educational system, is more feasible concept
Carrier Opportunity
1. Government sector in India
-Agriculture departments
-Agriculture Institute
-Excise Department
-Bureau of Indian Standards
-Import Export Departments
2. International and national wine making plant
-Vineyard management and marketing services
-Research techniques
-Technical assistance
-Winery laboratory technicians
-Wine marketing services
-Quality control in wine industry.
3. Self employment
-own winery
-winery consultant
-wine taster, wine maker

Eligibility:

Candidates applying for B.Sc. for wine technology should be H.S.C. science with biology disciplines OR 10 +2 years diploma course in agriculture or Diploma in fruit processing and wine Technology or Horticulture.

Admission procedure

Admission to the course will be based on performance in objective type entrance test (100 marks) and marks obtained in 10 + 2 level courses as mentioned above/ H.S.C. examination (50% wattage to marks obtained in entrance and 50% wattage to marks obtained in H.S.C. or equivalent courses).

Course structure

Duration: Three Years

UNIVERSITY OF PUNE	
NAME OF THE COURSE - B.SC. WINE TECHNOLOGY	
YEAR- FIRST YEAR	
FULL TIME/PART TIME- FULL TIME COURSE	

SR. NO	Code	Paper	Marks External	Marks Internal
1	WT-101	Paper 1 Microbiology	80	20
	WT-102	Paper 2 Microbiology	80	20
	WT-103	Microbiology Practical	80	20
2	WT-104	Paper 1 Botany	80	20
	WT-105	Paper 2 Botany	80	20
	WT-106	Botany practical	80	20
3	WT-107	Paper 1 Biochemistry	80	20
	WT-108	Paper 2 Biochemistry	80	20
	WT-109	Biochemistry practical	80	20
4	WT-110	Paper 1 Wine Technology	80	20
	WT-111	Paper 2 Wine Technology	80	20
	WT-112	Wine Technology practical	80	20
		TOTAL	960	240

Passing :

1. Passing marks out of 80 (External) will be 32 marks, out of 20 (Internal) will be 8 marks.
2. Other standards (A.T.K.T. Rules, Award of Class) will be same as Regular F. Y. B. Sc. Class.

Fee structure (F. Y. B. Sc.)

College Fees	Amount (Rs.)
Admission Fee	50
Tution Fees	6000
Identity Card Fees	50
Campus Development Fees	1000
Magazine Fee	100
Laboratory Fee	8000
Stationary and Internal Exam.	300
Wine Appreciation fee	2000
Vineyard and winery visit Fees/Field visit	2000
Total	19500

Infrastructure

A) Equipments

Sr. No.	Name of equipment	Quantity
1	Autoclave	1
2	Cooling Incubator	1
3	Oven	1
4	Centrifuge (Speed upto 5000 rpm)	1
5	Centrifuge (High speed)	1
6	Laminar airflow	1
7	Water distillation assembly	1
8	PH meter	1
9	Water bath	1
10	Shaker (variable speed)	1
11	Spectrophotometer UV- Visible range	1
12	Colorimeter	2
13	Single pan balance (Digital) – Accuracy 0.01 gm	1
14	Electronic balance (Single pan)- Weighing capacity 500 gm	1
15	Laboratory fermenter (1lit)	1
16	Refrigerator	1
17	Computer	2
18	Magnetic stirrer	1

B) Laboratory

Microbiology Laboratory

Biochemistry laboratory

Fermentation Laboratory (Pilot plant of winery: 50 KL capacity)

Staff room

Class room

WT-101 PAPER-1: Microbiology	Lectures
Term-1:-(Unit-1 and Unit-2)	
Unit-1 – Introduction to Microbiology	
1.1 The Scope of Microbiology	
1.2 The History of Microbiology	
1.3 The Characterization of micro-organisms- morphological, chemical, cultural, genetic and physiological characteristics.	(24) 3
1.4 Classification, nomenclature & Identification of microorganisms.	4
1.5 Introduction to light microscopy- principle and working of Bright field, Dark field and Phase contrast microscopy.	6 6
Unit-2. Morphology, Cultivation & Reproduction of Bacteria	
2.1 Size, shape & arrangement of bacterial cells.	5
2.2 Study of external & Internal bacterial cell structure.	
2.3 Classification of bacteria on the basis of their nutritional requirements.	(24)
2.4 Bacteriological media- Types of media & their applications.	3
2.5 Reproduction & Growth- Modes of cell division & normal growth cycle of bacteria.	5 5
Term-2 :-(Unit-3 and Unit-4)	
Unit-3. Microbial Genetics	5
3.1 DNA & RNA- structure, monomers, physicochemical structure of polymer	6
3.2 DNA replication Messelson & Stahl’s experiment.	
3.3 Gene expression; Genetic code, Transcription and Translation.	(24)
3.4 Mutation & its types, mutagens and mechanism of Mutagenesis.	5
3.5 Bacterial recombination- Transformation, conjugation & transduction.	5 5
Unit-4 Study of yeasts and their role in wine making.	5
4.1 Taxonomy of Yeast	4
4.2 Morphology, isolation, enumeration & identification.	
4.3 Life cycle of yeast	(24)
4.4 Factors affecting Yeast growth	6
4.5 Yeast metabolism : Fermentation, Pasteur effect, Crabtree effect	2 4 8 4

WT-102 PAPER-2: Microbiology	Lectures
Term-1:- (Unit-1 and Unit-2)	
Unit-1 Sterilization technique.	(24)
1.1 Concept of contamination, disinfection &sterilization	2
1.2 Sterilization by heat – use of dry & moist heat. D, F, Z values determination &significance. Pasteurization methods.	9
1.3 Sterilization by radiation, U.V. light & γ radiation.	3
1.4 Filtration: Bacteriological filters, types & uses, air sterilization.	5
1.5 Disinfectant types, action & applications, fumigation.	5
Unit-2.Fermentation Media	(24)
2.1 Components of typical fermentation medium	4
2.2 Role of nutrients in microbial growth	5
2.3. Crude sources of N & C	4
2.4 Antifoam agents	5
2.5 Stock cultures and its maintenance	6
Term-2 :-(Unit-3 and Unit-4)	
Unit-3 Industrial Microbiology	(24)
3.1 Definition & Scope of Industrial Microbiology	4
3.2 Historical development in fermentation industry.	3
3.3 Concept of fermentation and types of fermentation.	6
3.4 Components, construction and working of typical fomenter	6
3.5 Types of fomenter	5
Unit-4 Fermentation Process	(24)
4.1 Primary and secondary screening	5
4.2 Strain development	6
4.3 Inoculum preparation	5
4.4 Standard cultures, culture collection centers and their objectives and working	4
4.5 Concepts of upstream & down stream processing	4

WT-103 P Microbiology Practical**(96)**

- 1) Glassware used in Microbiology laboratory & its cleaning.
- 2) Study of different equipments- Bunsen burner, water bath, Autoclave, Laminar air flow, Incubator, Hot air oven, Spectrophotometer, Centrifuge, and Refrigerator.
- 3) Study of Microscope- Compound Microscope & its parts. Use of oil immersion objective.
- 4) Preparation of liquid medium -nutrients broth, sugar fermentation media.
- 5) Preparation of nutrient agar, agar slant , agar butt and glucose yeast extract medium (GYE).
- 6) Isolation of microorganism by streak plate method.
- 7) Isolation of microorganism by pour plate method.
- 8) Isolation of microorganism by spread plate method.
- 9) Dilution techniques of bacteria and yeast for enumeration.
- 10) Isolation of bacteria and yeast from natural sources.
- 11) Hanging drop preparation for observation of motility.
- 12) Staining of microorganisms by Monochrome staining.
- 13) Gram staining for differentiation of bacteria.
- 14) Negative Staining.
- 15) Staining for capsule.
- 16) Endospore staining.
- 17) Effect of pH on Microbial Growth.
- 18) Effect of Temperature on microbial growth.
- 19) Effects of salt on microbial growth.
- 20) Microscopic observation of fungi.

WT-104. Paper-I : Botany	Lectures
Term-1:- (Unit-1 and Unit-2)	
1. Introduction to Botany	(24)
1.1 Botany-Definition and concept.	4
1.2 Multidisciplinary nature of Botany	4
1.3 Structure of typical plant and different parts of plant	5
1.4 Structure of cell, cell cycle, cell division, mitosis and meiosis stages and their objectives and significance.	5
1.5 Mendel's laws of Inheritance with reference to monohybrid and dihybrid ratio	6
2. Physiology and anatomy of plants	(24)
2.1 Physiology –Definition, concept.	4
2.2 Definition and concept of photosynthesis, Structure of Chloroplast, Photochemical and biosynthetic phases, significance of photosynthesis.	5
2.3 Respiration –Definition and concept, structure of mitochondria, Glycolysis, TCA cycle, Significance of Respiration.	5
2.4 Transpiration – Definition, structure of stomata, concept and Significance of transpiration..	5
Translocation –Definition, concept, pathway of translocation. Source-sink relationship.	5
Term-2(Unit-3 and Unit 4)	
3. Inflorescence and flower structure in plants	(24)
3.1 Definition and significance of inflorescence	3
3.2 Types of inflorescence: racemose and cymose definition and types	6
3.3 Flower: Definition and symmetry, Thalamus and it's forms	5
3.4 Parts of flower: Pedicel, Thalamus, Floral whorls: calyx, corolla, androecium and gynoecium	5
3.5 Flower as a modified shoot: concept and evidence	5
4.Taxonomy and Embryology of plants	(24)
4.1 Definition, concept of embryology and taxonomy.	4
4.2 Taxonomy-Definition, scope and objective, Role palynology, embryology and phytotaxonomy in taxonomy.	5
4.3 Embryology-Definition and concept, structure of anther, pollen, pollen tube and Germination of pollen tube.	6
4.4 Structure of Ovule and embryo sac, Fertilization, formation of embryo.	5
4.5 Seed –structure and significance, germination, morphology	4

WT-105.Paper-2. Botany.	
Term-1:- (Unit-1 and Unit-2)	(24)
1. Anatomy of plants	4
1.1 Definition, concept, scope and objectives	6
1.2 Meristematic tissue system: Types of meristematic tissues based on their position - apical, intercalary, collenchyma.	6
1.3 Structure of simple tissues: parenchyma, collenchyma, Sclerenchyma, chlorenchyma	4
1.4 Complex tissue: Structure and function of xylem and phloem.	4
1.5 Secretory tissues: External and Internal secretory tissue system.	
2. Plant propagation	(21)
2.1 Propagation:-Definition, scope and objectives.	5
2.2 Sexual propagation (seed propagation, scope, significance)	5
2.3 Propagation materials-Definition, runner, sucker, tuber, merits and demerits.	5
2.4 Propagation by artificial method- Cutting and Layering- definition and types.	4
2.5 Tissue culture techniques.	5
Term-2(Unit-3 and Unit 4)	(24)
3. Economic Botany	5
3.1 Introduction, important of plants and plant products.	6
3.2 Medicinal plants-concepts, active principle, plant parts used and uses with reference to awala, ginger, clove, cinnamon, adulsa, aloe.	6
3.3 Ornamental plants-concepts, important, uses, with reference to suitable examples	5
3.4 Timber wood, with reference to suitable example.	4
3.5 Other products like; gum, resin, dye.	4
4. General introduction to anatomy	(24)
4.1 Introduction and definition	3
4.2 Importance, applications in taxonomy, phylogenetic studies.	7
4.3 Wood identification and pharmacognosy.	5
4.4 Internal structure of typical dicot and monocot root.	4
4.5 Internal structure of typical dicot and monocot stem	5

<p>WT: 106P Botany Practical.</p> <ol style="list-style-type: none"> 1. Study of typical plant and plant parts. 2. Study of cell division: mitosis and meiosis 3. Study of stomata and transpiration in plants 4. Study of meristematic tissue system. 5. Study of complex and permanent tissue system. 6. Study of secretory tissue system. 7. Study of plant propagation by using different propagation methods. 8. Study of economically important plants. 9. Study of translocation in plants. 10. Study of embryological evidences in plants. 11. Observation of different types of inflorescence in plants. 12. Observation of parts of flower. 13. Inoculation of nodal sector or apical bud. 14. Preparation of nursery beds and rising of seedling per plant. 15. Observation of embryo in maize plant. 16. Study of trichomes. 17. Observation of typical dicot root and stem. 18. Observation of typical monocot root and stem. 19. Study of different maceration techniques. 20. Testing presence of phenols in the plant tissue by ferric chloride test. 21. Separation of leaf pigments by strip chromatography. 22. To show that CO₂ is necessary for photosynthesis. 	<p>(96)</p>
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WT 107 Paper I Biochemistry	Lectures
Term – 1 (Unit – 1, & Unit -2)	
Unit-1 Introduction to Biochemistry	(24)
1.1 Concept & scope of Biochemistry	2
1.2 Application of biochemistry in wine science	4
1.3 Biochemistry of bacterial & yeast cell components & their functions	12
1.4 Comparison of prokaryote & eukaryote metabolism.	6
Unit – 2 Fundamentals of Biochemistry	(24)
2.1 Types of bonds	4
2.2 Structure & Properties of water	5
2.3 pH, pKa & buffers	5
2.4 Concept of oxidation- reduction and its relation to energy release.	5
2.5 Principles of analytical techniques - Introduction to chromatography, spectrophotometry & electrophoresis	5
Term 2 [Unit 3 & 4]	
Unit 3 The Macromolecules	(24)
3.1 General concept of monomer, polymer & various bonds in polymers like, glycosidic, peptide, phosphodiester & ester linkages as they appear in biomolecules	4
3.2 Carbohydrates – Definition, classification, properties & function of carbohydrates	4
3.3 Proteins- Definition , classification, general properties & function of proteins, structure & classification of amino acids	6
3.4 Lipids- definition, classification, general properties and function of lipids.	6
3.5 Vitamins- Definition, classification, properties, sources & function of vitamins	04
Unit-4 Enzymes	(24)
4.1. Definition, structure & general properties	4
4.2 Models for enzyme catalysis.	3
4.3 Concept of enzyme regulation- Feed back inhibition & Feedback regulation, allosteric regulation, isoenzymes	6
4.4 Effect of substrate concentration, pH, temperature, metal ions, inhibitors & activators on enzyme activity.	7
4.5 Enzyme nomenclature & classification upto subclass with examples.	4

WT108 Paper II Biochemistry	Lectures
Term I (Unit 1 & 2)	
Unit- I Metabolic Pathways	(24)
1.1 Definitions & Concepts: Catabolism, anabolism, amphibolic pathways, anaplerotic reactions, central energy yielding pathways	4
1.2 Carbohydrate metabolism	9
a). E.M.P., Gluconeogenesis	
b). H.M.P , Starch hydrolysis- [Enzymatic]	
c). T.C.A. cycle	
1.3. Protein - families of amino acids	4
1.4 Nucleic acid- introduction to de novo & salvage synthesis.	4
1.5 Fatty acid degradation- β - oxidation	3
Unit – 2 Bioenergetics-	(24)
2.1 Concept of bioenergetics, free energy Laws of thermodynamics and their relevance to metabolism	6
2.2 Principles of bioenergetics	
a). Concept of free energy & its relation to feasibility & direction of reaction	4
b). Activation energy barriers & reduction of this barrier	2
c). Electron transport chain- Mitchell's theory of ATP formation	4
d). Concept of high energy bond & high energy compound	4
e) Substrate level & oxidative phosphorylation	4
Term II (Unit 3& unit 4)	
Unit -3 Fermentation	(24)
3.1 Biochemistry of ethanol Fermentation	6
3.2 Concept of Primary & secondary metabolites with examples	6
3.3 Concept of mass balance with respect to ethanol fermentation	6
3.4. Overview of anaerobic fermentations by bacteria eg. Lactic acid, propionic acid, butanol, butyric acid etc.	6
Unit 4 Metabolic Regulation	(24)
4.1 Concept of homeostasis	2
4.2 Metabolic regulation	15
a) Gene level – meaning of positive & negative regulation of transcription	
b) Concept of operon [Lactose & tryptophan operon,]	
c) Regulation at Enzyme level - feed back inhibition and its types	
4.3 Pasteur & Crabtree effect	7

	WT 109P Biochemistry Practical	(96)
01	Laboratory Equipments a). Distillation unit b) Colorimeter & spectrophotometer c) pH meter d) Balance of different capacities e) Centrifuge [General introduction to above equipments their operation & application]	
02	Laboratory Procedures a) Cleaning of glasswares, tabletop, floors, laminar flow units etc. b) Laboratory record book maintenance c) Safety practices in Laboratory	
03	Titration of a) Strong acid, strong base, weak acid, strong base b) Iodometric titration	
04	Determination of pKa; preparation of buffers Use of pH indicator & pH meter	
05	Practicals on carbohydrates a) Detection of sugars (Benedicts/Felhing) detection of starch, differentiation between reducing & non reducing sugar b) Estimation of total sugar by phenol sulphuric method. Estimation of reducing sugar by DNSA c). Paper chromatography of sugars.	
06	Practicals on Proteins a). Paper Chromatography of amino acid b). Protein estimation- Folin Lowry method	
07	Practicals on lipids a). Extraction of lipids in organic solvents. (chloroform, methanol) b). TLC of lipids	
08	Practicals on Nucleic Acid a). Demonstration - DNA isolation	
09	Practicals on enzymes a) Estimation of Amylase activity & specific activity determination	
10	Practicals on water a) Water: Determination of chlorine b) Determination of alkalinity c) Determination of heavy metals d) Determination of salts	

WT-110. Paper-I. Wine Technology	Lectures
Term: 1 (Unit 1 and Unit 2)	
Unit 1 Introduction	(24)
Winemaking: Introduction to winemaking, definition and terminologies.	4
Viticulture: Introduction to viticulture, definition and terminologies.	4
History of wine-making and viticulture:	5
Wine-producing regions of the world and different practices of wine making & viticulture.	6
Status of Indian viticulture and winemaking.	5
Unit 2 Introduction to grapevine and concept of Terrior	(24)
2.1 Grapevine: Classification, anatomy and function of various parts of grapevine	7
2.2 Cultivars and development of hybrids varieties of grapevine.	5
2.3 Introduction of soil and influence on the grapevine: Structure of soil and growth of grapevine roots and shoot system	5
2.4 Effect of climatic condition on the cultivation of grapevine (sunlight, temperature, wind, rain, hail, frost).	4
2.5 <i>Terrior</i> : Concept of Terrior, Terrior units and importance of Terrior	3
Term:2 (Unit 3 and Unit 4)	
Unit -3 Wine-making	(24)
3.1 Classification of wine: Generic classification, varietal classification, Vinification classification and classification on the basis of chemical Constituents.	6
3.2 Flow chart of white wine-production and recommended varieties.	4
3.3 Flow chart of Red wine-production and recommended varieties.	5
3.4 Flow chart of Fortified wine-production and recommended varieties.	5
3.5 Production of wine from fruits other than grapes.	4
Unit-4 Vine and Wine	(24)
4.1 Present scenario of viticulture in different Countries: Variation in varieties selection, wines, harvesting, irrigation practices, clonal selection and other mechanization practices.	6
4.2 Grape variety as criteria for quality wine production: Study of criteria such as tractability, distinctive flavors, other special characteristics.	3
4.3 Introduction to barrel: Distribution, species and advantages of oak, anatomical and chemical constituents of oak and liberation of oak flavors from the barrel or cask in wine.	5
4.4 Barrel making and maintenance: Harvesting of oak wood, selection and seasoning of oak wood for barrel making and maintenance or storage of barrels in the winery.	5
4.5 Automation in wine industry: Importance of automation operation in wine industries and concept of Programmed Logic Control System.	5

WT-111.Paper-2.Wine Technology	
Term: 1 (Unit 1 and 2)	
Unit 1. Introduction to sensory evaluation of wine	(24)
1.1 Sensory evaluation and terminologies: Importance of sensory Evaluation of wine and study of terminologies used in describing wine.	4
1.2 The basic tastes of wine and sensory perception: The taste of bitterness, acidity, salt, sweetness, glycerol and alcohol on the tongue, study of tongue anatomy with reference to sensory response and study of perception.	6
1.3 The technique of tasting wine: Selection of glass, serving temperature, design of room for wine tasting, timing of tasting wine and taste the wine on the basis of three important senses i.e. vision, smell/aroma and palate structure.	5 4
1.4 Sensory evaluation and score-card: Rose worthy score-card, Davis score-card and Sparkling wine score-card	5
1.5 Matching wine with food: Theory of food combination such as sweet, sour, salty and spicy food with wine.	
Unit 2. Commercial aspects of wine production	(24)
2.1 Comparison of wine with other beverages: Wine with vodka, Gin, Brandy, Whiskey, Rum, Beer, fruit wines fruit juice, carbonated drinks.	6
2.2 Traditional and commercial wine-making: A comparison of traditional and new wine-making practices	4
2.3 Raw materials and equipment use in wine production: crusher, press fermentor, filtration and additives used in wines	6
2.4 Vintage and quality of wine: Vintage year in Southern and Northern Hemisphere and management of vintage	5
2.5 Economic significance of grape growing and winemaking.	3
Term: 2 (Unit 3 and 4)	
Unit 3. The world of wine	(24)
3.1 Wine appellations and regulations: Study of wine laws of European nations, USA, Australia, New-Zealand, South Africa, Chile and India	6
3.2 Chemical constituents of grapes and wines: Sugar, Acids, Phenolics and Alcohol	6
3.3 Wine and health: Beneficial and harmful effects of wine on the human health.	4
3.4 Serving wine: Opening the bottle, selection of bottle for different wine style and type of glass and storing of wine in cellar or wine shop or supermarket.	4
3.5 Wine marketing: Importance of marketing in wine industry and the current wine marketing scenario.	4

Unit 4. The new concept in wine production	(24)
4.1 Organic wines: Organic viticulture and wine-making practices	5
4.2 Biodynamic wines: Definition of biodynamic, application and importance of biodynamic wine-production, products used in the biodynamic and certification in biodynamic.	7
4.3 The concept of precision viticulture: Definition of precision viticulture, advantages and disadvantages associated with precision viticulture, practices and application of precision viticulture in vineyard	4
4.4 New trends in the world of wine: Advantages and disadvantage of different closure (Screw cap, cork, Zork, synthetic cork, vino seal and crown caps) used for wine bottles.	4
4.5 Global warming and its impact on grape cultivation and wine production in wine producing regions of the world.	4

WT-112P. Wine Technology Practical**(96)**

1. Identification of grape and wine varieties.
2. A small survey on “*Wine as an alcoholic drink*”: Report writing
3. A visit to the winery: Report writing
4. Study of a 50 KL winery.
5. Identification of basic tastes of wine in water
6. Threshold detection of acid taste.
7. Threshold detection of sweet taste.
8. Threshold detection of bitter taste.
9. To identify the Indian *Terrior*:
10. Types of glasses and wines
11. Effect of the serving temperature on wines
12. Wine tasting and score card
13. Identification of the aroma constituents in the given sample
14. Interaction of sweet and acid taste
15. Interaction of sweet, acid and bitter taste.
16. Effect of pH on the sensory evaluation of wine
17. Effect of age on the appearance of white and red wine
18. The sense of feel
19. The art of tasting wine: White, Red, Rosé and sparkling wine
20. Matching wine with food.

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Biochemistry (WT-107 & WT 108)

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Botany (WT-104 & WT-105)

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