Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B. Sc. Degree Course in

WINE TECHNOLOGY

Syllabus

(To be implemented from Academic Year 2019-20)

F.Y. B. Sc.
(Wine Technology)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Preamble:

Wine Technology, being one of the youngest branch of Life Science, has expanded and established as applied science. Global and local focus has slowly shifted to not only current "Century of Knowledge" but also on to technology development and application in life sciences. Although, wine has traditionally been consumed throughout history with evidence dating back to Harappa civilization, commercial wine production is a pretty recent phenomenon, with the first commercial grape wine plant being set up only in the 1980s. Since then, three major players – Chateau Indage, Grover Vineyards and Sula Vineyards – emerged in the domestic winemaking scene and the last few decades saw vineyards cropping up all over the country.

Then came the tide of globalization and India, bowing to WTO's demands, had to reduce tariffs on imported liquor with the consequence that the market was suddenly flooded with incredibly refined Italian and French wines of unmatched quality – much to the delight of the wine lovers and to the woe of the Indian winemakers.

Coming back to the present times, finding a foothold in an area that has been eternally dominated by European players (read: France, Italy, and Spain, in that order) has been quite an uphill task for Indian winemakers. However, the recent growth numbers – the wine market is currently growing at a rate of 25-30 per cent – have given them some cause to celebrate. A larger market translates to more demand, which in turn means that Indian wines can, now, share a shelf with their French and Italian counterparts. Moreover, Indians wines are considerably cheaper than their Western counterparts; thus, enabling it to achieve a particular target audience of its own.

Back home, statistics reveal that India's rich and prosperous are finally warming up to this delicious drink; India has a wine market of roughly 1.2 million cases, while experts predict that consumption will grow at a CAGR of around 30% during 2009-2013. Lastly, right marketing strategies and increased awareness will go a long way to ensure that this historically significant drink finally conquers Indian hearts.

Introduction:

The syllabi till today had been sufficient to cater to the needs of students for building up their careers in industry and research. However, with the changing scenario at local and global level, we feel that the syllabus orientation should be altered to keep pace with developments in the education and industrial sector. The need of the hour is to design appropriate syllabi that emphasize on teaching of technological as well as the economical aspects of Wine, Alcohol and Brewing industry. Theory supplemented with extensive practical skill sets will help a graduate student to avail the opportunities in the applied fields (research, industry or institutions), without any additional training. Thus, the university / college itself will be developing the trained and skilled man-power.

Objectives to be achieved:

- To introduce the concepts in various allied subjects
- To enrich students' knowledge
- To help the students to build interdisciplinary approach
- To inculcate sense of scientific responsibilities and social and environment awareness
- To help students build-up a progressive and successful career

Eligibility: 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

SPECIAL FEATURES
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 importance 3. 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 Brewing, Wine and Alcohol Industry
-Vineyard management and marketing services
-Research techniques
-Technical assistance
-Winery laboratory technicians
-Wine marketing services
-Quality control in Brewing and wine industry.
3. Self employment
-own winery, Brewery
-winery consultant
-wine taster, wine maker

Course Structure:

- CGPA will be calculated based on core 132 credits only
- Each theory credit is equivalent to 15 clock hours of teaching(12hrs classroom+3hrs of tutorials-active learning method) and each practical credit is equivalent to 30 clock hours of teaching in a semester.
- For the purpose of computation of workload, the following mechanism may beadopted as per
- UGC guidelines:
  1 Credit = 1 Theory period of one-hour duration per week
  1 Credit = 1 Tutorial period of one-hour duration per week
  1 Credit = 1 Practical period of two-hour duration per week
- Each theory Lecture time for FY, SY, TY is of 1 hour = 60 min
- Each practical session time for FY is of 3 hour = 180 min
- Each practical session time for SY & TY is of 4 hour = 240 min

Award of Credits:

- Each course having 4 credits shall be evaluated out of 100 marks and student should secure at least 40 marks to earn full credits of that course.
- Each course having 2 credits shall be evaluated out of 50 marks and student should secure at least 20 marks to earn full credits of that course.
- GPA shall be calculated based on the marks obtained in the respective subject provided that student should have obtained credits for that course.

Evaluation Pattern:

- Each course carrying 100 marks shall be evaluated with Continuous Assessment(CA) and University Evaluation (UE) mechanism.
- Continuous assessment shall be of 30 marks while University Evaluation shall be of 70 marks. To pass in a course, a student has to secure minimum 40 marks provided that he should secure minimum 28 marks in University Evaluation (UE).
- Each course carrying 50 marks shall be evaluated with Continuous Assessment (CA) and University Evaluation (UE) mechanism.
- Continuous assessment shall be of 15 marks while University Evaluation shall be of 35 marks. To pass in a course, a student has to secure minimum 20 marks provided that he/she should
- secure minimum14 marks in University Evaluation (UE).
- For Internal examination minimum two tests per paper of which one has to bea written test 10 marks
- Methods of assessment for Internal exams: Seminars, Viva-voce, Projects,Surveys, Field visits, Tutorials, Assignment, Group Discussion, etc (on approval of the head of the centre)

ATKT Rules:

- Minimum number of credits required to take admission to Second Year of B. Sc.: 22
- Minimum number of credits required to take admission to Third Year of B.Sc.: 44
- Completion of Degree Course:
- A student who earns 140 credits, shall be considered to have completed the requirements of the B. Sc. degree program and CGPA will be calculated for such student

Title of the Course: B.Sc. (Wine Technology)

Structure of the course:

Theory **Semester: I**

Course Code	Course Title	Credits	Number of Hours	Marks
WT-101	Basic Microbiology Paper I	2 Credits	30	50 (35 External +15 Internal)
WT-102	Industrial Microbiology Paper I	2 Credits	30	50 (35 External +15 Internal)
WT-103	Introduction to Botany	2 Credits	30	50 (35 External +15 Internal)
WT-104	Plant Development and Anatomy	2 Credits	30	50 (35 External +15 Internal)
WT-105	Basic Biochemistry Paper I	2 Credits	30	50 (35 External +15 Internal)
WT-106	Metabolic Pathways Paper I	2 Credits	30	50 (35 External +15 Internal)
WT-107	Wine Technology	2 Credits	30	50 (35 External +15 Internal)
WT-108	Sensory Evaluation of wine paper-I	2 Credits	30	50 (35 External +15 Internal)

Practicals

WT-109	Practicals in Microbiology	1.5 Credits	10 P	50 (35 External +15Internal)
WT-110	Practicals in Botany	1.5 Credits	10 P	50 (35 External +15 Internal)
WT-111	Practicals in Biochemistry	1.5 Credits	10 P	50 (35 External +15 Internal)
WT-112	Practicals in Wine Technology	1.5 Credits	10 P	50 (35 External +15 Internal)
Total Credits (Theory + Practical)		**22 Credits**		

Title of course : B. Sc (Wine Technology)

Structure of the Course

Semester : II

Theory

Course Code	Course Title	Credits	Number of Hours	Marks
WT-201	Basic Microbiology Paper II	2 Credits	30	50 (35 External +15 Internal)
WT-202	Industrial Microbiology Paper II	2 Credits	30	50 (35 External +15 Internal)
WT-203	Plant Physiology	2 Credits	30	50 (35 External +15 Internal)
WT-204	Applied Botany	2 Credits	30	50 (35 External +15 Internal)
WT-205	Basic Biochemistry Paper II	2 Credits	30	50 (35 External +15 Internal)
WT-206	Metabolic Pathways Paper II	2 Credits	30	50 (35 External +15 Internal)
WT-207	Introduction to Beer, Wine and Alcohol Technology	2 Credits	30	50 (35 External +15 Internal)
WT-208	Sensory evaluation of wine paper-II	2 Credits	30	50 (35 External +15 Internal)

Practicals

WT-209	Practicals in Microbiology	1.5 Credits	14 P	50 (35 External +15 Internal)
WT-210	Practicals in Botany	1.5 Credits	14 P	50 (35 External +15 Internal)
WT-211	Practicals in Biochemistry	1.5 Credits	14 P	50 (35 External +15 Internal)
WT-212	Practicals in Wine Technology	1.5 Credits	14 P	50 (35 External +15 Internal)
Total Credits (Theory + Practical)		**22 Credits**		

Course Code :WT-101 Basic Microbiology paper-I (2 Credit course) Total Hours=30

Serial No.	Topics	No. of Hours
Credit One	**1.1 Introduction, History, Branches and Scope of Microbiology** :- Contribution of Scientists to the field of Microbiology- Antony Von Leuwenhoek, Edward Jenner, Lazaro Spallanzani, Louis Pasteur, Joseph Lister, Robert Koch, Alexander Fleming and Iwanovsky. **1.2Importance, occurrence and types of microorganisms :-** Classification of microorganisms, Difference between prokaryotic and eukaryotic cells, types of bacteria, fungi, viruses, protozoa and algae.	10
Unit -2.	**Microbial Physiology :-** **2.1** Cell – Biology – Detailed study of bacterial cell organelles, cell wall, cell membrane, capsule, endospore, flagella, types of flagella, mechanism of flagellar movement. **2.2** Cell inclusions (Gas vesicles, carboxysomes, PHB granules, metachromatic granules, glycogen bodies, starch granules, magnetosomes, sulfur granules, chlorosomes)	10
Unit – 3.	**Microbiology of yeast:** 3.1Yeast – Definition, comparison with other microorganisms 3.2Yeast morphology and taxonomy, yeast cell structure and functions of various cellular components. 3.3 Role of fungi in various fermentations :- Examples of various fermentations using yeast with special reference to Glycerol, baker's yeast, etc.	10

Course Code :WT-102 Industrial Microbiology paper-I (2 Credit course) Total Hours=30

Unit No.	Topics	No. of Hours
Unit -1.	**Unit-1 Industrial Microbiology** 1.1 Definition & Scope of Industrial Microbiology . 1.2 Historical development in fermentation industry. 1.3 Role of microbiology in industry.	10
Unit -2.	**Unit-2 Sterilization technique.** 2.1 Concept of contamination, disinfection &sterilization 2.2 Sterilization by heat – use of dry & moist heat. Pasteurization methods and its types. 2.3 Sterilization by radiation, U.V. light & γ radiation. 2.4 Filtration: Bacteriological filters, types & uses, air sterilization. 2.5 Disinfectant types, action & applications, fumigation	12
Unit –-3.	**Pure culture techniques :-** 2.1Design & preparation of media – Nutritional . requirements ingredients of media. 2.2 Types of media. 2.3Preservation of pure culture techniques, slant culture preservation, Lyophilization.	08

Course Code :WT-103 Introduction to Botany (2 Credit course) Total Hours=30

Unit No.	Topics	No. of Hours
Unit 1	**Introduction to Botany**	17
	1.1 Botany - Definition and Multidisciplinary nature of Botany	
	1.2 Plant as a living system-General & Unique features of plants as living organisms, Plant diversity – concept,	
	1.3 Morphology of vegetative plant organs, Structure of typical plant and different parts of plant (Root, Stem & Leaf)	
	1.4 Reproductive development: Shift from vegetative to reproductive phase	
	1.5 Inflorescence: Definition, Types of inflorescence and Significance of inflorescence	
	1.6 Morphology - of reproductive plant organs Flower: Definition and symmetry, Parts of flower: Pedicel, Thalamus, Floral whorls: calyx, corolla, androecium and gynoecium	
	1.7 Fruit & its types	
Unit 2	**Plant Cell Biology & Genetics**	13
	2.1 Unique features of a plant cell	
	2.2 Cell cycle, cell division, mitosis and meiosis stages and their significance	
	2.3 Programmed Cell Death- ageing, senescence and necrosis	
	2.4 Overview of Mendel's laws of Inheritance with reference to monohybrid and dihybrid ratio, Codominance & Incomplete dominance	
	2.5 Linkage & Crossing Over	

Course Code :WT-104 Plant Development and Anatomy (2 Credit course) Total Hours=30

Unit No.	Topics	No. of Hours
Unit 1	**Plant Development**	**15**
	1.1 Unique features of plant, Shift from vegetative to reproductive phase & factors affecting	
	1.2 Microsporogenesis, development of male gametophyte and male gamete	
	1.3 Megasprogenesis, development of female gametophyte and female gamete	
	1.4 Double fertilization and triple fusion & Development of endosperm	
	1.5 Embryogenesis- Monocot & Dicot embryogenesis	
	1.6 Plant growth regulators and their role in growth and development	

	(*in vivo* & *in vitro* response)	
Unit 2	**Plant Anatomy**	15
	2.1 Definition, concept, scope and objectives.	
	2.2 Meristem & Meristematic tissue system: Types of meristematic tissues based on their position & function.	
	2.3 Structure & function of simple tissues: parenchyma, collenchyma, Sclerenchyma	
	2.4 Complex tissue: Structure and function of xylem and phloem & Concept of Mechanical Tissue system	
	2.5 Epidermal & Secretary tissue system	
	2.6 Anatomy of Monocot & Dicot (root, stem & leaf)	

Course Code :WT-105 Basic Biochemistry paper-I (2 Credit course) Total Hours=30

Unit No.	**Topics**	**No. of Hours**
Unit-1	1.1 Introduction to Biochemistry. 1.2 Concept & scope of Biochemistry. 1.3Application of biochemistry in wine science.	02
Unit-2	**Water**: 2.1Types of bond, Covalent and non-covalent interactions in biomolecules with suitable examples. 2.2 Properties of water, Hydrogen bonding, ionization of water, interaction of biological molecules in water, osmosis. 2.3Buffers - Biological buffers-concept ,types and their importance.	08
Unit-3	**Carbohydrates:** 3.1Classification of carbohydrates –Monosaccharides ,Oligosaccaharides and Polysaccharide. 3.2 Monosaccharides: Structure & properties of Monosaccharides, ketoses and aldoses, D and L configuration, epimers, anomers, chemical and physical properties; glycosidic bonds, reducing and non-reducing sugars. 3.3 Oligosaccharides: Sucrose ,Lactose and Maltose. 3.4 Polysaccharides and its classification. 3.5 Functions of Carbohydrate	10
Unit-4	**Lipids:** 4.1Classification of lipids: Simple & complex lipids, fatty acids. 4.2 Structure , chemical and physical properties, 4.3 Complex lipids: Phospholipids and Glycolipids. 4.4 Function of lipids.	09

Course Code :WT-106 Metabolic Pathways paper-I (2 Credit course)Total Hours=30

Unit No.	Topics	No. of Hours
Unit -1.	Bioenergetics : 1.1Concept of bioenergetics :Concept of free energy, Laws of thermodynamics and their relevance to metabolism. 1.2Exothermic reactions and Endothermic reactions. 1.4 Concept of high energy bond & high energy compounds. 1.5 Substrate level & oxidative phosphorylation.	08
Unit -2.	Metabolism :Definitions & Concepts: Catabolism, anabolism, anapleurotic reactions.	04
Unit -3.	Carbohydrate metabolism: 3.1 Glycolysis(E.M.P.) and fates of pyruvate. 3. 2 Fermentation.. 3.3 T.C.A. cycle.	09
Unit -4.	4.1 Electron transport System . 4.2 Fatty acid degradation- β- oxidation in relation to energy production.	09

Course Code :WT-107 Basic Wine Technology (2 Credit course) Total Hours=30

Unit No.	Topics	No. of Hours
Unit-1	1.1Wine making: Introduction to winemaking, important terminologies of wine. 1.2 Viticulture: Introduction to viticulture, important terminologies. 1.3 Wine history (“old” and “new” world wine) . 1.4 Terrior: Concept of Terrior and importance of Terrior.	10
Unit-2	2.1 Classification of wine: Generic classification, varietal classification, Vinification classification and classification on the basis of chemical Constituents. 2.2 Flow chart of white wine-production and recommended varieties. 2.3 Flow chart of Red wine-production and recommended varieties. 2.4 Flow chart of Sparkling wine-production and recommended varieties. 2.5 Production of wine from fruits other than grapes(apple).	10
Unit-3	3.1 Grapevine - Classification, function of various parts of grapevine. 3.2 Common wine grape varieties –red and white grape varieties 3.3 Chemical Constituents of Wines. 3.4 Introduction to barrel: Distribution, species and advantages of oak.	10

Course Code :WT-108 Sensory Evaluation of Wine paper-I (2 Credit course) Total Hours=30

Unit No.	Topics	No. of Hours
Unit-1	1.1 Sensory evaluation and terminologies 1.2 The basic tastes of wine : bitterness, acidity, salt, sweetness, and alcohol on the tongue. 1.3 Sensory perception -study of tongue anatomy with reference to sensory response. 1.4 Factors influencing taste perception.	10
Unit-2	2.1 The art of tasting wine – color ,aroma and taste of wine. 2.2 Neurophysiological mechanism of tasting . 2.3Sensory evaluation and score-card: Rose worthy score-card, Davis score-card and Sparkling wine score-card. 2.4 Introduction to aroma wheel.	10
Unit-3	3.1 Design of tasting room , timing of tasting wine. 3.2 Taste the wine on the basis of three important senses i.e. vision, smell and palate structure. 3 .3 Selection & different types of glass, serving temperature of wine. 3.4Serving wine: Opening the bottle, selection of bottle for different wine style.	10

Course Code - WT 109 : Practicals based on Microbiology (1.5 Credit Course)
Total practicals -14

Sr. No	Experiment Title	No. of Practicals
1	Safety Measures and Good Laboratory Practices in Microbiology laboratory .	1
2	Introduction, operation, precautions and use of common microbiology laboratory instruments: Incubator, Hot Air Oven, Autoclave, Colorimeter, pH Meter, Chemical Balance, Laminar air flow hood, Centrifuge .	2
3	Introduction and use of common laboratory glass wares: Test tubes, Culture tubes, suspension tubes, screw capped tubes, Petri plates, Pasture pipettes, Erlenmeyer flask, volumetric flask, glass spreader, Durhams tube, Cragie's tube and inoculating needles (wire loop, stab needles) .	1
4	Learning basic techniques in Microbiology: Wrapping of glassware, Cotton plugging, cleaning and washing of glassware, Inoculation of bacterial culture, Biological waste disposal. Aseptic transfer techniques (slant to slant, broth to broth, broth to agar and Agar to Agar) .	1
5	Study of Microscope- Compound Microscope & its parts. Use of oil immersion objective.	1
6	Basic staining techniques: i) Monochrome staining ii)Negative staining.	2
7	Staining of Endospore	1
8	Staining of Capsule	1
9	Hanging drop preparation for observation of motility.	1
10	Preparation of liquid medium -nutrients broth, Sabouraud broth and PDB	1
11	Preparation of nutrient agar medium, agar slant and PDA	1
12.	Wet Mount slide preparation and its observation – Bacteria and Fungi.	1

Course Code - WT 110 : Practicals based on Botany (1.5 Credit Course)
Total practicals -14

Sr. No.	Topics	Number of Practical's
1.	Study of typical plant and plant parts	**01**
2.	Observation of different types of inflorescence in plants.	**01**
3.	Observation of parts of flower	**01**
4.	Study of different types of fruits	**01**
5.	Study of plant cell types using squash techniques and Maceration	**02**
6.	Study of Programmed Cell Death in plants	**01**
7.	Study of meristematic tissue system	**01**
8.	Study of complex and permanent tissue system.	**02**
9.	Study of trichomes & secretary tissue system	**01**
10.	Observation of typical monocot root and stem	**01**
11.	Observation of typical dicot root and stem	**01**
12.	Study of embryological evidences in plants & Observation of embryo in monocot & dicot seeds	**02**

Course Code :WT-211 Practical based Biochemistry (1.5 Credit course)
Total practical = 14

Sr. No	Experiment Title	No of Practicals
1	Safety Measures and practices in chemistry laboratory.	1
2	Molarity , molality , normality, ppm ,ppb.	1
3	Laboratory Equipments : Working Principle and Handling a) Distillation unit b) Colorimeter & spectrophotometer c) pH meter d) Balance e) Centrifuge	2
4	Preparation of Buffers of desire pH and Molarity – Acetate buffer and phosphate buffer.	1
5	Determination of alkalinity of water.	1
6	Titration of Strong acid with the strong base.	1
7	Titration of Weak acid with strong base.	1
8	Determination of Ascorbic acid by colorimeter .	1
9	Estimation of reducing sugar by DNSA method.	1
10	Paper chromatography of sugars.	1
11	TLC of amino acids/ Sugars	2
12	Determination of λmax using colorimeter	1

Course Code :WT-112 Practical based on Wine Technology (1.5 Credit course)
Total practical = 14

Sr. No	Experiment Title	No of Practicals
1	Introduction to Wine technology Laboratory and common Wine technology laboratory instruments e.g. Refractometer, Hydrometer Colorimeter, pH Meter, Distillation Unit, Chemical Balance etc	2
2	Identification of grape and wine varieties.	2
3	A small survey on *"Wine as an alcoholic drink":* Report writing.	2
4	To study threshold detection of acid taste.	1
5	To study threshold detection of sweet taste.	1
6	To study threshold detection of bitter taste.	1
7	To study threshold detection of bitter taste.	1
8	Study of aroma wheel.	1
9	Types of wine glasses.	1
10	Study of a 50 KL winery.	2

Recommended Textbooks and References for Microbiology :

1. 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. 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. 9 Panda U. N. (2005) Handbook of Microbiology and parasitology
10. Anuradha De. (2009) Practical and applied microbiology
11. Prescoff Hurley Kline's(2008) Microbiology
12. Sathe S. T. Pharande S. R.(2010) Introduction to Microbiology

Recommended Textbooks and References for Botany :

1. 1.Naik, V.N (1991). Taxonomy of Angiosperm. Tata McGraw-Hill Publishing Company Ltd., New Delhi
2. Lawerence, G.H.M. (1967). Taxonomy of Vascular plants. Oxford & IBH Publishing Co. Calcutta
3. Majumdar, R.B. (1963). An Introduction to Spermatophyta. Merit Publishers, Calcutta
4. Singh, V. & Jain, D.K.(1996). Taxonomy of Angiosperms. Rastoghi Publ., Merrut, India
5. Ariens, E.J., Simonis, A.M. and Offermeiers, J. (1976). Introduction to General Toxicology, Academic Press, New York
6. Pandey, K., Shukla, J.P. and Trivedi, S.P. Fundamentals of Toxicology, New Central Book Agency, Kolkata
7. Datta, S.C. (1980). Plant Physiology, Central Book Depot, Allahabad

Recommended Textbooks and References for Biochemistry :

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

Deb A. C.(2004) Fundamentals of biochemistry

Recommended Textbooks and References for Wine technology :

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

F.Y.B.Sc Wine technology Semester -II

Course Code :WT-201 Basic Microbiology paper-II (2 Credit course) Total Hours=30

Unit No.	Topics	No of Hours
Unit -1.	**Microscopy**: 1.1Principles of Microscopy- resolving power, resolution, contrast, numerical aperture, working distance and magnification. Rayleigh criteria, Working . 1.2Principles and applications of a) Bright field microscope & b) Dark field microscope. 1.3Electron Microscopy – TEM, SEM.	10
Unit -2.	**Microbial Growth**: 2.1Growth curve, introduction to kinetics of growth, generation time, growth rate. 2.2 Reproduction in microorganisms : sexual reproduction and asexual reproduction_. 2.3 Measurement of Bacterial growth- Methods of enumeration: Microscopic methods (Direct microscopic count, counting cells) ,Plate counts (Total viablecount) , Turbidometric methods.	12
Unit – 3.	**Staining Techniques:** 3.1 Definitions of Stain; Types of stains (Basic and Acidic). 3.2Properties and role of Fixatives, Mordants, Decolourisers and Accentuators . 3.3Monochrome staining , Negative (Relief) staining and Differential staining - Gram staining .	8

Course Code :WT-202 Industrial Microbiology paper-II (2 Credit course) Total Hours=30

Unit No.	Topics	No of Hours
Unit -1.	**Unit-1.Fermentation Media** 1.1 Components of typical fermentation medium . 1.2Role of nutrients in microbial growth. 1.3 Crude sources of N & C. 1.4Antifoam agents . 1.5 Stock cultures and its maintenance . 1.6 Industrial microbiological products as Primary and secondary metabolites.	15
Unit -2.	**Unit-4 Fermentation Process** 2.1Concept of fermentation and types of fermentation. 2.2 Primary and secondary screening . 2.3 Strain improvement 2.4 Inoculum preparation – outline. 2.5 Standard cultures, culture collection centres and their objectives and working . 2.6 Concepts of upstream &downstream processing .	15

Course Code :WT-203 Plant Physiology (2 Credit course) Total Hours=30

Unit No.	Topics	No of Hour
Unit 1	**Plant Physiology: Plant water relations & Primary Metabolism**	**17**
	1.1 Physiology –Definition, concept	
	1.2 Permeability, Diffusion, Osmosis – Definition, significance, types, mechanism, laws and factors affecting, Osmotic pressure (OP), turgor pressure (TP) and wall pressure (WP), relation between OP, DPD (Suction pressure) and TP	
	1.3 Absorption of water: Ascent of sap –Cohesion-tension theory	
	1.4 Transpiration & Gutation – Definition, concept (structure of stomata & Hydathodes) & Significance	
	1.5 Overview of Photosynthesis & Respiration: Definition and concept, Structure of Chloroplast, Photochemical and biosynthetic phases, Photosynthesis in plants, significance of photosynthesis and Photorespiration, structure of mitochondria	
	1.6 Translocation –Definition, concept, pathway of translocation, Sourcesink relationship.	
Unit 2	**Stress Physiology, Physiology of Flowering, Seed Germination, and Fruit ripening**	**13**
	2.1 Plant & its interaction with surrounding (Biotic & Abiotic components)	
	2.2 Response of plants to biotic stresses and abiotic stresses	
	2.3 General classification & major pathways of secondary metabolites & its role	
	2.3 Introduction to physiology of flowering: a) photoperiodism and b) vernalization	
	2.4 Metabolic changes during seed germination & fruit ripening	

Course Code :WT-204 Applied Botany (2 Credit course) Total Hours=30

Unit No.	Topics	No of Hours
Unit 1	**Methods of Plant Propagation**	**11**
	1.1 Propagation:-Definition, scope and objectives, Types of Plant propagation; Sexual propagation and asexual plant propagation & its advantages and disadvantages	
	1.2 Sexual Propagation: Seed development and viability, seed dormancy, growing seedlings in indoor containers and field nurseries, seedling transplanting; advantages and disadvantages of seed propagation.	
	1.3 Vegetative propagation- organs used in propagation- Natural- bulbs, corns, tubers, rhizomes (storage organs), stolons and runners.	
	1.4 Artificial propagation-Cutting, layering (air and ground), grafting and budding; advantages and disadvantages of artificial propagation.	
Unit 2	**Plant Tissue Culture**	**19**
	2.1 Concepts of Cell theory & Cellular totipotency, Landmarks in plant tissue culture.	
	2.2 Organization of plant tissue culture laboratory – General laboratory & Inoculation room, Culture room, different work areas, equipments & instruments required	
	2.3 Media preparation & Aseptic techniques – Nutritional requirements of explant, Preparation of media & its sterilization, Washing, packing & sterilization of glass wares, surface sterilization, Aseptic work station, precautions to maintain aseptic conditions.	
	2.4 'Explant' for plant tissue culture, Concept of differentiation, dedifferentiation and redifferentiation, Callus formation, organogenesis & embryogenesis	
	2.5 Organ culture technique – Introduction, principle, factors affecting w.r.t. root tip culture, leaf culture, shoot tip & meristem culture & its applications	
	2.6 Concept of Haploid production & its applications	
	2.7 Concept of embryo and endosperm culture & its applications	
	2.7 Micropropagation and Somaclonal variations	

Course Code :WT-205 Basic Biochemistry paper-II (2 Credit course) Total Hours=30

Unit No.	Topics	No of Hours
Unit-1	**Proteins:** 1.1 Amino acids and their Classification. 1.2 Protein structure: ,Primary structure, Secondary structure, Tertiary and Quarternary structure , bonds in protein molecules . 1.3Protein denaturation and renaturation. 1.4Functions of proteins,	12
Unit-2	**Enzymes-** 1.1Definition, general properties, enzyme activation and inhibition. 2.2Models for enzyme catalysis. 2.3Enzyme classification.	10
Unit-3	**Nucleic acids**- Definition, general structure of DNA and RNA.	04
Unit-4	**Vitamins :** Classification**,** Biochemical functions of fat soluble and water soluble Vitamins.	04

Course Code :WT-206 Metabolic Pathways paper-II (2 Credit course) Total Hours=30

Unit No.	Topics	No. of Hours
Unit -1.	**Protein metabolism** : A) Transamination and oxidative deamination. B) Metabolic fates of amino acids. C) Urea cycle.	8
Unit -2.	**Nucleic acid**- Metabolism: Introduction to de novo & salvage synthesis.	4
Unit -3.	**Fermentation :** a) Biochemistry of ethanol Fermentation. b) Concept of Primary & secondary metabolites with examples. c) Overview of anaerobic fermentations by bacteria eg. Lactic acid.	10
Unit – 4.	**Metabolic Regulation** a) Concept of homeostasis. b) Regulation at Enzyme level – feed back inhibition and its types.	8

Course Code :WT-207 Basic of Beer, Wine and Alcohol Technology (2 Credit course) Total Hours=30

	Topics	No of Hours
Unit-1	1.1 Traditional and Commercial winemaking practices: A comparative study. 1.2 Raw materials and equipment use in wine production: crusher, press fermentor, pump and additives used in wines . 1. 3Automation in wine industry: Importance of automation operation in wine industries . 1.4 New concept in wine production – organic wine and biodynamic wine .	10
Unit-2	2.1 Introduction and History of Brewing 2.2 Basic concept of alcoholic beverages - Vodka, Gin, Brandy, Whiskey, Rum, Beer, Fruit wines, Carbonated drinks. 2.2 Alcoholic beverage and health: Effects on the human health. 2.3 Status of Indian brewing, winemaking and alcohol.	10
Unit-3	3.1 Anatomical and chemical constituents of oak and liberation of oak flavors from the barrel in beer and alcohol; cask in wine . 3.2Work with barrels (stacking, maintenance). 3.3Oak chips versus oak barrels. 3.4 Pre-fermentation actions (use of enzyme ,skin contact ,maceration). 3.5 Role of sulphur-di-oxide in vilification.	10

Course Code :WT-208 Sensory Evaluation of Wine paper-II (2 Credit course) Total Hours=30

	Topics	No of Hours
Unit-1	1.1 Concept of wine clarity . 1.2 Wine aroma - primary ,secondary ,tertiary aroma . 1.3 off odors in wine – sulfur odor, oxidation, geranium, vegetative, corky. 1.4 New trends I n 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.	10
Unit-2	2.1Intorudction to tasting sheet: White wine . 2.2 Introduction to tasting sheet : red wine . 2.3 Introduction to tasting sheet : sparkling wine . 2.4 Matching wine with food: Theory of food combination such as sweet, sour, salty and spicy food with wine.	10
Unit-3	3.1 Pre- tasting organization – testing area, number of samples replicates ,temperature , cork removal,decanting,dispensers,glasses ,number of tasters . 3.2Tasting situations – wine competitions, trade tasting ,wine appreciation courses, home tasting . 3.3 Tasting exercises – Duo –trio test ,blind tasting, triangular taste . 3.4 Study of effervescence , ISO standard glass, Tears .	10

Course Code:-WT 209 Practicals based on Microbiology (1.5 Credit Course)
Total practicals: 14

Sr. No	Experiment Title	No of Practicals
1	Isolation of bacteria and yeast from natural sources.	1
2	Observation of the growth of cultures and reporting of colony and cultural characteristics (Nutrient agar, Sabouraud's agar)	1
3	Isolation of microorganism by streak plate method	1
4	Isolation of microorganism by spread plate method	1
5	Isolation of microorganism by pour plate method.	1
6	Yeast for enumeration of yeast by Neubauer's chamber.	1
7	Special staining techniques: Gram staining for differentiation of bacteria.	2
8	Effect of pH on Microbial Growth.	1
9	Effect of salts on microbial growth.	1
10	Effect of Temperature on Microbial Growth	1
11	Aseptic Transfer Techniques	1
12	Microscopic observation of fungi.	1
13	Preservation of cultures on slants .	1

Course Code:-WT 210 Practicals based on Botany (1.5 Credit Course)
Total practicals: 14

Sr. No.	Topics	Number of Practical's
1.	Study of osmosis and turgor pressure	**01**
2.	Determination of Diffusion Pressure Deficit using potato tubers.	**01**
3.	Study of translocation in plants.	**01**
4.	Determination of rate of respiration	**01**
5.	Study of stomata and transpiration in plants	**01**
6.	Testing presence of phenols in the plant tissue by ferric chloride test.	**01**
7.	Separation of leaf pigments by strip chromatography	**01**
8.	Preparation of nursery beds and rising of plants by different propagation methods	**01**
9.	PTC Laboratory: organization of facility and equipment, Aseptic manipulation – washing, capping, packing & sterilization, laminar flow operation and safety precautions	**02**
10.	Stock solutions & media preparation	**01**
11.	Effect of plant growth regulators on in vitro response of explants.	**02**
12.	Initiation of shoot tip & axillary bud culture, anther culture	**02**

Course Code :WT-211 Practical based on Biochemistry (1.5 Credit course)
Total practical = 14

Sr. No	Experiment 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	1

Course Code :WT-212 Practical based on Wine Technology (1.5 Credit course)
Total practical = 14

Sr. No	Experiment Title	No of Practicals
1	Scoring of wine using different tasting sheet.	1
2	Sensory evaluation of white wine and red wine.	2
3	Filed visit and report writing –Vineyard /Winery.	2
4	Matching wine with food.	1
5	Effect of age on the appearance of white and red wine.	1
6	Interaction of sweet and acid taste.	1
7	Interaction of sweet, acid and bitter taste.	2
8	Effect of the serving temperature on wines.	1
9	Effect of pH on the sensory evaluation of wine.	1
10	The sense of feel.	1
11	Identification of off odors in wine.	1

Recommended Textbooks and References for Microbiology :

1. 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. 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. 9 Panda U. N. (2005) Handbook of Microbiology and parasitology
10. Anuradha De. (2009) Practical and applied microbiology
11. Prescoff Hurley Kline's(2008) Microbiology
12. Sathe S. T. Pharande S. R.(2010) Introduction to Microbiology

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01. Bhojwani, S.S.,&Bhatnagar, S.P. An embryology of Angiosperm
02. Maheshwari, P. An Introduction to embryology of Angiosperm
03. Pandey, S.N. & Ajanta Chadha. Plant Anatomy and Embryology. Vikas Publishing House Pvt. Ltd., New Delhi
    Chandurkar, P.J. (1983). Plant Anatomy. Oxford & IBH Publishing Co, Calcutta
04. Khan, M.R., Ahire, S.V., Gadekar, S.S., Parale, A.P. and Auti, S.G.(2014) Plant Anatomy& Embryology and
    Plant Biotechnology, Success Publication.
05. Eames, A.J. &Macdaniels, L.H.(1947) An Intriduction to Plant Anatomy . McGraw-Hill, N.Y. and London
06. Esau,K. (1977). Anatomy of seed plants, John Wiley & Sons, Inc. London
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11. Gokhale, S.B. and Kokate, C.K. (1987). Pharmacognosy
12. Wallis,T.E.(1985). A Text book of Pharmacognosy, CBS Publishers & Distributors, New Delhi
13. Sadhu, M.K. (1989). Plant Propagation. Wiley Eastern Ltd. New Delhi.
14. De, K.K.(2004). An Introduction to Plant Tissue Culture. New Central Book Agency (P.) Ltd. Kolkata
15. Devlin, R.M. (1969). Plant Physiology, Affiliated East-West Press Pvt.Ltd. New Delhi
16. Razdan, M.K.(1996). An Introduction to Plant Tissue Culture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Recommended Textbooks and References for Biochemistry :

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
Deb A. C.(2004) Fundamentals of biochemistry

Recommended Textbooks and References for Wine technology :

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
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8.Emile Peynalld (1984) Knowing & making wine
9.Patrice Iland & Peter Gago (1997) Australian wine from the grasp vine to the glass