Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B. Sc. Degree Program in

WINE, BREWING AND ALCOHOL TECHNOLOGY

Syllabus

(To be implemented from Academic Year 2021-22)

T.Y.B.Sc.
(Wine, brewing and alcohol technology)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2021-2022

Preamble:

Wine Technology, being one of the youngest branches 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. Wine, Brewing And Alcohol 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 controlling 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 be adopted as per UGC guidelines:
    - Each theory Lecture time for FY, SY, TY is one lecture of 50 min
    - Each practical session time for FY is of 3 hour 15 min = 195 min
    - Each practical session time for SY & TY is of 4 hour 20 min = 260 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 2 tests per paper of which one has to be 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.: 31 [70%]
- Minimum number of credits required to take admission to Third Year of B.Sc.: 44 credits [100%] to be completed from F.Y.B.Sc and at least 22 credits from S.Y. B.Sc
- 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.

Semester: V
T.Y.B.Sc
Title of program: Wine, Brewing and Alcohol Technology
Structure of the Program
Theory

Course Code	Course Title	Credits	Number of Hours	Marks
WBAT 351	Basic Chemical Engineering	2Credits	30	50 (35External+15Internal)
WBAT 352	Equipment & utilities	2Credits	30	50 (35External+15Internal)
WBAT 353	Health benefits of alcoholic beverages -I	2Credits	30	50 (35External+15Internal)
WBAT 354	Microbial spoilage and other defects	2Credits	30	50 (35External+15Internal)
WBAT 355	Marketing of alcoholic beverages	2Credits	30	50 (35External+15Internal)
WBAT 356	Business management	2Credits	30	50 (35External+15Internal)
WBAT 357	Practical course –I	2Credits	12 P	50 (35 External +15Internal)
WBAT 358	Practical course –II	2Credits	12 P	50 (35 External +15Internal)
WBAT 359	Practical course –III	2Credits	12 P	50 (35 External +15Internal)
WBAT 3510	Bio analytical Techniques	2Credits	30	50 (35External+15Internal)
WBAT 3511	Computer aided applications	2Credits	30	50 (35External+15Internal)
Total Credits (Theory+ Practical)		**22 Credits**		

Semester: VI
T.Y.B.Sc
Title of program: Wine, Brewing and Alcohol Technology
Structure of the Program

Theory

Course Code	Course Title	Credits	Number of Hours	Marks
WBAT 361	Sensory evaluation of wine, beer and alcohol	2Credits	30	50 (35External+15Internal)
WBAT 362	Waste treatment paper –II	2Credits	30	50 (35External+15Internal)
WBAT 363	Health benefits of alcoholic beverages-II	2Credits	30	50 (35External+15Internal)
WBAT 364	Maturation and aging of alcoholic beverages	2Credits	30	50 (35External+15Internal)
WBAT 365	Alcohol marketing laws and regulatory polices	2Credits	30	50 (35External+15Internal)
WBAT 366	Wine technology- III	2Credits	30	50 (35External+15Internal)
WBAT 367	Practical course –I	2Credits	12P	50 (35 External +15Internal)
WBAT 368	Practical course –II	2Credits	12 P	50 (35 External +15Internal)
WBAT 369	Project	2Credits	-	50 (35 External +15Internal)
WBAT 3610	Brewing technology -II	2Credits	30	50 (35External+15Internal)
WBAT 3611	Alcohol technology - II	2Credits	30	50 (35External+15Internal)
Total Credits (Theory+ Practical)		**22 Credits**		

Semester: V

WBAT 351-Basic Chemical Engineering (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A)Basic fluid flow and fluid mechanics:** a) Fluid, branches of fluid mechanics, properties of fluid, classification of fluids, Newton's law of viscosity, numerical, non-newtonian fluids, types of flow, lines to describe the flow, viscometers. b) Basic equations of fluid flow: continuity equation and equation of motion, flow measurement using venturi meter, orifice meter, pitot tube, rotameter, numerical. c) Pump selection and performance: characteristic diagrams of pumps, net positive suction head, computation of pump requirements **B) Energy for wine processing** a) Steam generation: steam generation systems, thermodynamics of phase change, steam tables, steam utilization b) Electric power utilization: electrical terms and units, Ohms law, electric circuits, electric motors, electrical controls	3 6 3 3 3
II	**A) Refrigeration** a) Selection of refrigerants, components of refrigeration system (evaporator, compressor, condenser and expansion valve) b) Basic design of chilling systems, calculation of heat loads **B) Heat Transfer and Thermal Processing:** a) Introduction to heat transfer, modes of heat transfer conduction, convection and radiation. Systems for heating and cooling of liquids plate heat exchanger, tubular heat exchanger. b) Thermal processing: Decimal reduction time (D), thermal resistance constant, thermal death time (F). relationship between chemical kinetics and thermal processing parameters: decimal reduction time, rate constants k and Q10 thermal resistance constant z, activation energy Ea and their inter-relationship	3 3 6 5

References:

1. Analytical instruments- Chilton Book company.
2. Chaiwal, Gurdeep P.& Anand, Sham- Industrial Methods of chemical Analysis, Analytical instruments
3. Gurdeep & Anand, Sham (2007).- Industrial methods of chemical Analysis
4. Liptak, Bela G.-Flow measurements
5. Mccabe, Warren L. , Smith, Julian C. &Harriott, Peter -Unit operations of chemical engineering
6. Richardson, J. F. & Peacock, D. G. Coulson &richardson's - Chemical engineering vol. 3

Semester V

WBAT-352 Equipment and Utilities (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A) Required utilities services** : a) **Water**– Various water sources, Hardness and need for softening, Water pressure requirements, Hot water needs & systems. b) **Electric supply** – Power supply requirement to run various equipment's, air-conditioning, humidifiers, dehumidifiers, Chilling system. **B) Industrial Equipment:** **Study the functions and uses of each equipments -** Sorting tables, receivers/ hoppers, pneumatic press, de-stemmers and crushers, basket press. Heat exchangers -plate heat exchanger & tube –in-tube exchanger. Study of tanks used in wine and beer-. Temperature sensors, actuators, display and control panel, hoses and fittings, micro-oxygenation systems, various filters and clarification equipment used in winery as well as in brewery.	2 3 13
II	**A) Winery & brewery Sanitization:** Functions, types, and uses of - CIP systems, sanitization, pressure cleaners, spray nozzles, air locks, pest controllers, bottling, filtration systems, pest controllers **B) Special Lab equipment's**: Functions, types, and uses of - ebulliometer, centrifuge, dissolved oxygen meter, torque tester, colorimeter, oven/ dessicator, sampling devices, pressure checking equipment, spectrophotometer ,bottling machines, fillers, corking machines, screw cappers, labeling machines	4 14

References:

1. Buglass, Alan J. - Handbook of alcoholic beverages technical, analytical and nutritional aspects vol.1 & 2
2. David, Bird-Understanding wine technology- Vol.1, Resources
3. David, Storm- Winery utilities: planning, design and operation
4. Liptak, Bela G.-Analytical instruments
5. Roger, B. Boulton, and Vernon Singleton- Principles and practices of winemaking

Semester: V

WBAT-353 Health Benefits of Alcoholic Beverages– I (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A) Antioxidant** : a) Basic concept of anti-oxidant and free radical, b) Wine antioxidant – formation of reactive oxygen species and cell damage c) Wine polyphenols as anti-oxidant and free radical scavengers d) Major wine anti-oxidant – procyanidins, salicylic acid, DHB'S, epicatechin, gallic acid, quercetin & resveratrol e) French paradox & protective effect of moderate alcohol consumption, synergism of alcohol & antioxidant in wine	2 3 4 5 4
II	**A) Moderate alcohol consumption and associated health benefits** a) Moderate alcohol consumption & associated health benefits – To liver, lungs, heart, anti-aging effect, reduction in various causes of mortality, ulcers, kidney stone, use of alcohol in treatment of fever & as antiseptic etc. b) Role of antioxidant in preventing – cardiovascular disease, cancer, gouts, anti-degenerative disease – Parkinson's Disease, Alzheimer's Disease, rheumatoid arthritis, fetal alcohol syndrome, antimicrobial effect of alcohol, allergies & hypersensitivity	9 9

References:

1. Andrea, Schaffer-Red wine for your health
2. Bruce, Zoecklein, Kenneth Fugelsang and Barry Gump. Wine analysis and Production
3. Buglass, Alan J. Handbook of alcoholic beverages technical, analytical and nutritional aspects vol.1 and vol .2
4. Catherine, Cheze, Joseph Vercauteren, R. Verpoorte, Polyphenols- Wine and health.
5. C. A. Crampton, Fermented Alcoholic Beverages, Malt Liquors,Wine and Cider
6. Ron S. Jackson.,Wine science

Semester: V

WBAT-354- Microbial Spoilage and Other Defects (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A)Microbial spoilage**	1
	a) Introduction to microbial spoilage.	2
	b) Origin of wine spoilage microorganisms.	1
	c) General features of spoilage microorganisms – yeast and bacteria.	2
	d) Identification of wine spoilage microorganisms.	
	B) Wine microbial spoilage and its control	
	a) Faults caused by yeast and molds.	1
	b) Faults caused by acetic acid bacteria	1
	c) Faults caused by LAB - bitterness taint, diacetyl taint, geranium taint, ropiness mannitol taint, mousiness, refermentation, etc	4
	d) Faults caused by other aerobic bacteria and cork induced spoilage.	1
	e) Killer factor- killer yeast, toxins, significance of killer yeast in wine making.	2
	f) Control of microbial spoilage	3
II	**A) Wine defects – origin and remedies**	
	a) Concept of defect, defining flaws and faults, flaws appearance	2
	b) Oxidation: - defect caused by acetaldehyde, acetic acid	2
	c) Defect caused by sulphur compound –sulphuroxides, hydrogen sulphide ,mercaptans , dimethyl sulphide etc.	2 4
	d) Study of various practical techniques to solve defects during processing –phenolic wines- harsh and drying tannins, deacidification, acidification, dealing with stuck fermentation.	
	e) Additives allowed in making wine: Study of compounds and levels listed by OIV/AWRI/ BIS.	3
	B) Beer defects – causes and effect	
	a) Oxidation and staling of beer	1
	b) Foam stability –formation of haze by polyphenol (polypeptidehaze), calciumoxalate, carbohydrates	3
	c) Microbiological contamination in beer- brewery spoilage microorganisms	1

References:

1. Barter, E. Denis& Hughes, Pall S.-Beer: quality safety and nutritional aspects
2. Boulton, Roger B - Principles and practice of winemaking
3. Graham, fleet -Wine microbiology & biotechnology
4. John hudelson – wine faults –causes ,effect and cures
5. P.Ribereau and Gayon, D. - Handbook of Enology, Vol.1: the microbiology of wine and vinification
6. Patrick ILAND, Nick BRUER -Monitoring the wine making process from grapes to win techniques and concepts
7. Ron S. Jackson. –Wine science

Semester: V

WBAT-355 Marketing of Alcoholic Beverages (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A) Introduction to Marketing** a) Fundamentals of Marketing b) Basic Wine Marketing Principles c) 4P`s of Marketing	4
	B)Fundamentals of Marketing Management a) Introduction, definition b) Importance and functions of Marketing Management c) Henri Fayol 14 principles	4
	C) Buying Behavior a) Buying Motives of Wine, Beer and Alcohol Consumers. b) Importance of Studying Buying Behavior c) Factors influencing buying behavior d) Buying Decision Process	5
	D) Basics of Branding and Marketing Strategies a) Difference between Brand and Branding b) Basics of Brand Positioning c) Wine, Beer and Alcohol Branding	5
II	**A) Digital /Social Media Marketing of Wine, Brewing and Alcohol** a) Definition of Digital Marketing b) Importance of Digital Marketing in Beverage Industry	3
	B) International Marketing a) Introduction b) Types of International Marketing (Export, Franchising, Licensing, Joint Venture) c) International Marketing strategy	5
	C) Business Environment in Alcohol Industry a) Introduction to Business Environment b) Important Environmental Factor of Brewery, Winery Distillery c) SWOT Analysis technique	6
	D) Marketing Techniques used by Alcohol Industry (Advertisement Management) **a)** Surrogate Marketing **b)** Define Advertising & Importance of Advertising **c)** Other marketing technique (Case study)	4

References:

1. Ingle Russell,Graham Stewart- Whisky: technology, production and marketing (handbook of alcoholic beverages)
2. Magandep Singh -The Indian tpirit
3. Philip Kotler- Marketing management
4. Paul Wagner, Janeen Olsen, Liz Thach-Wine marketing & sales

Semester: V

WBAT-356 Business Management (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A) Principles of Management** a) Definition and meaning of Management b) Development of Management Thoughts c) Different Management Approaches d) Scientific Management Approach e) Administrative Approach f) Behavioral Approach g) International Marketing Approach	7
	B) Function of Management a) Planning and organizing b) Importance of Planning and organizing c) Types of organization d) Define Staffing e) Recruitment directing f) Motivation and leadership communicating g) Level of Management	7
	C) Entrepreneurship a) Introduction to Entrepreneurship b) Types of Entrepreneurships(Small, Startups, Large, MSME) c) Differentiate between Business and Entrepreneurship and making business plans	4
II	**A) Business Information System** a) Management Information Systems (MIS) b) e-Business Information System	4
	B) Business Communication a) Definition, Importance b) Method of Business Communication-Verbal, non-verbal, written, Upward – downward & horizontal c) Soft skills – Definition, Importance, Elements of good speaking & listening, Interview skills, techniques of Interview. d) Business Letters – Meaning, Importance, Structure of Business Letter	4
	C) Financial Management in Business a) Definition of Finance and Business Finance b) Definition of Financial Management c) Objectives of Financial Management d) Pricing Strategies of Alcohol Industry	5

	D)Supply Chain Management a) Introduction on Supply Chain Management b) Definition of Demand & types of Demand – What is Demand Curve c) Demand& Supply Network d) Case Study of any One Company`s SCM	5

References:

1. Azhar, Kazmi- Business Policy
2. C. Paramasivan& T. Subramanian`s- New Age Financial Management
3. M, Balusubrahmanian -Business communication
4. Narayanamurthy, Gopalakrishnan, and Anand Gurumurthy- A case study on downstream supply chain of an Indian alcoholic beverage manufacturer–some insights for the global business.
5. Noah, Rathbaum -The Business of Spirits: How Savvy Marketers, Innovative Distillers, and Entrepreneurs Changed How We Drink
6. P.C.Pardeshi- Business communication
7. Rastogi, Sumit- Financial Management
8. Shukla and Saxena- Business Organization and Management

Semester V

WBAT - 357: Practical course – I (2 Credit Course)

Sr No.	Experiment Title	No. of Practical's
1	Measurement of properties of liquids (must, wine, sugar syrups etc) using Specific gravity bottle and Hand held refractometer	1
2	Calculation of heat load, chilling plant specifications etc, using a laboratory Plate heat exchanger/ shell & tube heat exchanger	1
3	Measurement of viscosity of liquids using Capillary tube viscometer, Rotational viscometer	1
4	Measurement of flow of liquids using Orifice meter and Venturi meter	1
5	To study the characteristics of simple distillation and Calibration of pH meter.	1
6	To study the filtration of liquids through cake filters and Practical calculation of refrigeration loads for wine storage	1
7	Estimation of thermal death coefficient k for normal wine contaminants	1
8	To study CIP process in winery /brewery /distillery	1
9	Demonstration of principal and working process of Ion exchange and pneumatic press	1
10	Filtration of liquids through cake filters, Estimation of flux as a function of ΔP, area, etc calculation of values of α and β in the Darcy equation	1
11	Demonstration of principal and working process of filtration unit	1
12	Demonstration of principal and working process of Crusher and destemmer	1

Semester V

WBAT - 358: Practical course – II (2 Credit Course)

Sr No	Experiment Title	No. of Practicals
1	Effect of glucose and NaCl concentration on yeast growth.	1
2	Effect of variable pH on yeast growth.	1
3	Determination of sensitivity of yeast to antibiotic streptomycin.	1
4	Study of normal flora of grape berry and leaf.	1
5	Identification of lactic acid bacteria by biochemical methods.	1
6	Identification of acetic acid bacteria by biochemical method.	1
7	Isolation of spoilage micro organism from wine sample.	1
8	Experiment the practical techniques to solve harsh tannin defects and excessive acidity defect in given wine	1
9	Case study on Microbial ecology during vinification: natural flora of grapes and other fruits, interactions of microorganisms, host-pathogen interaction	1
10	Comparative Study on oxidized effect in white wine i.e oxidized wine vs. non oxidized wine and to verify the resistance of wine to air.	1
11	To study sulfite /$S0_2$ calculation for potassium metabisulfite additionand Hygiene of grapes before and after crushing.	1
12	Identification of various defects in given spoiled wine	1

Semester V

WBAT - 359: Practical course – III (2 Credit Course)

Sr No	Experiment Title	No. of Practicals
1	To Study the Profiles of Indian Alcohol Companies and compare Marketing Strategies of Various Alcoholic Brands (Any one Sector Wine/Beer/Alcohol)	1
2	To Study the Digital Marketing / Social Media Marketing Champaign of Wine / Beer / Liquor Brand	1
3	Case Study on Consumer Buying Behaviour Pattern (National/ International)	1
4	To study and Compare Pricing strategies across various alcoholic brands in same sector and design your own Pricing strategy of either Wine/Beer/Alcohol	1
5	To Study Bottle Labelling and Packaging	1
6	Presentation (PPT) on Branding Strategies of Particular Wine, Beer, Alcohol Brand	1
7	To develop SWOT Analysis of any Wine/Beer/ Liquor Brand	1
8	To study the Organisation structure of any Winery/Brewery/Distillery	1
9	To Compare National and International Alcohol Beverage Market	1
10	Seminar -I – Any topic from Syllabus (Marketing Management)	1
11	Seminar -II - Any topic from Syllabus (Business Management)	1
12	Visit to Winery/ Brewery/ Distillery	1

Semester V

Skill Enhancement Course
WBAT- 3510 Bio analytical Techniques (2 Credit course)
Total No. of lectures =36

Credit	Bioanalytical Techniques Topic	No of Lectures
I	**A) Introduction:** Labsafety,scientificnotationandunits,biochemicalcalculations,buffer solutions, measurement of pH	3
	B) Spectroscopy: a) The electromagnetic spectrum b) Concept and measurement of transmittance and absorbance c) Beers Lamberts law, molar extinction coefficient, limitations of Beers Lamberts law d) Types of spectrometers–UV & visible; Principles, Instrumentation and Applications	8
	C) Centrifuge: a) General principle- sedimentation velocity, sedimentation equilibrium b) Types of centrifuges: preparative and analytical centrifugation, Differential centrifugation, density gradient, ultracentrifuge c) Applications	7
II	**A) Chromatographic Techniques:** a) Introduction to chromatography, General principles b) Planar Chromatography c) Partition chromatography: Thin layer chromatography, paper d) chromatography e) Column chromatography–columns, stationary phases. f) Packing of columns, application of sample, column development, fraction collection and analysis. g) Adsorption chromatography: Ion Exchange Chromatography, Size h) exclusion chromatography	10
	B) Electrophoresis: a) General principle, factors affecting electrophoresis voltage, current, resistance, buffer, composition, concentration, pH. b) Agarose Gel electrophoresis c) SDS-PAGE–Native and denaturing gels, d) Applications	8

References:

1. Wilson K and Goulding K.H., Abiologist's guide to Principles and Techniques of Practical Biochemistry
2. Willard and Merrit, Instrumental Methods and Analysis
3. Ewing GW, Instrumental Methods of Chemical analysis.
4. Vogel's, Text Book of Quantitative Chemical Analysis, 6th Edition, 2004.
5. Raymond P.W. Scott, Techniques and Practice of Chromatography–Vol.70.
6. Sethi P.D, Dilip Charegaonkar, Chromatography–2nd Edition.
7. Hanes, Gel Electrophoresis of Proteins- A Practical Approach,
8. Biophysical chemistry by Upadhyay, Upadhyay and Nath, Himalaya publication house.

Semester V

Skill Enhancement Course
WBAT- 3511 Computer aided applications (2 Credit course)
Total No. of lectures =36

Credit	Bioanalytical Techniques Topic	No of Lectures
1.5	**A) Computer Fundamentals.**	
	a) Overview to computer system.	1
	b) Types of computers.	1
	c) Introduction to hardware and software.	1
	d) Types of software.	1
	e) Application software.	1
	f) Representation of data.	1
	g) Components of computer – CPU, Memory.	1
	h) Input and Output devices- keyboard, mouse, monitors, printers.	1
	i) Storage devices- types of storage devices, magnetic storage devices, optical storage devices	5 1
	B) Operating system.	
	a) Type of operating system.	1
	b) Basic and advance operating system.	1
	c) Working of operating system.	1
	d) Environment for operating system.	1
	e) Application of different operating system.	1
	C) Internet and e-mail applications.	1
	a) History and uses of internet.	1
	b) Connecting to internet	2

WBAT- 3510 Computer aided applications Practicals (0.5 Credit course)
Total Lectures 15

Sr.No.	Topic	No. of lectures
1.	Project on MS- word.	5
2.	Project on MS-excel.	5
3.	Project on Power point	5

Semester: VI

WBAT- 361 Sensory evaluations of wine, beer and alcohol (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**Beer sensory Evaluation :** a) Visual aspect in beer –concept of beer foam, beer foam components ,foam parameter and foam structure ,foam assessment, beer color and beer clarity b) Flavor determinants of beer – i. Taste of beer –sweetness, sourness, saltiness, bitterness ii. Beer aroma iii. Beer flavor wheel c) Liqueurs and their flavoring: - Basic concept of fruit and fruit flavored liqueurs, different botanicals used in liqueurs	8 6 4
II	**A) Sensory evaluation of different wine types/style** a) Sauvignon Blanc wine style with respect to appearance ,aroma ,flavors , tastes and mouthfeel b) Chardonnay wine style wine style with respect to appearance ,aroma ,flavors , tastes and mouthfeel c) Riesling wine style wine style with respect to appearance ,aroma ,flavors tastes and mouthfeel d) Botrytis effected sweet white wine style with respect to appearance ,aroma ,flavors and tastes and mouthfeel e) Cabernet sauvignon wine style with respect to appearance, aroma, flavors, tastes and mouthfeel. f) Merlot wine style with respect to appearance, aroma, flavors and tastes and mouthfeel. g) Pinot noir wine style with respect to appearance, aroma, flavors and tastes & mouthfeel h) Sherry wine style with respect to appearance, aroma, flavors and tastes & mouthfeel **B) Sensory evaluation of whisky**: - a) Aroma taste, mouth & visual characteristics, flavor wheel b) Sensory evaluation during whisky production during and of the finished product	 2 1 1 2 2 1 1 2 3 3

References:

1. Buglass - Handbook of alcoholic beverages
2. Emile,Peynavd - The taste of wine
3. Inge, Russell and graham- Whisky: Technology,production and marketing
4. Jackson, Ronald S. - Wine testing a professional handbook
5. Jockson,Ron S. - Wine science principles practices & perception
6. Patrice,Iland& Peter, Gago- Australian wine from the grasp vine to the glass
7. Roger,B.Boulton- Principles and practices of wine making
8. Vine, Richard P - Wine appreciation

Semester: VI

WBAT-362 Waste Treatment Paper -II (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A)Basic Concept in waste water treatment –** Waste, Pollutant, Sludge, Eutrophication, microbial Bioremediation, Phyto - remediation, Bio-stimulation, Bio augmentation, Xenobiotic Components	4
	B)Waste water Treatments – a) Measurement of BOD, COD, TOD of waste water i. BOD- Five-day BOD procedure & extended BOD test manometric BOD test, BOD assessment is minutes, factor that contribute to variation in BOD-Seed, PH, temperature, toxicity, incubation time, nitrification ii. COD – Standard dichromate COD procedure, COD detector. iii. TOD - TOD analyzer	6
	C) Detection of pathogenic organism of sewage – Index organisms of sewage, laboratory method for detection of coliform organism by MTF technique, MFT technique, Colilert technique, techniques to distinguish fecal bacteria from non –fecal bacteria	8
II	**A)Tertiary treatment of waste water** a) Solid remover from waste water b) Removal of phosphorus from waste water (by biological & Chemical Methods) c) Removal of nitrogen from waste water d) In-situ bioremediation and Ex-situ bioremediation e) Disposal of effluent –Sea and rivers ,lagoons ,spray irrigation ,land filling ,composting ,incineration etc f) Concept of 4R principle in waste treatment	1 2 2 3 4 1
	B)Waste water treatment of some industry – a) Outline of waste water treatment for distillery and sugar industry b) Outline of waste water treatment for winery	3 2

References:

1. Bela .G Litak - Analytical instrumentation.
2. Casida L.E.-Industrial microbiology
3. Inge Russell and graham – Whisky: technology, production and marketing
4. R.S. Ramalho- Introduction of waste water treatment
5. Singh, B.D.- Biotechnology
6. Srivastava, M.L. - Fermentation technology.
7. Stanbuzy, Peter & Whitaker, A.- Principal of fermentation technology

Semester: VI

WBAT- 363 Health benefits of alcoholic beverages- II (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A) Nutritional value of Alcoholic beverages :-** a) Outline of nutrient content of various alcoholic beverages – Wine &Cider b) Nutritional aspects beer c) Macronutrient contents of Alcoholic beverages, water, Alcohol, Carbohydrate, Nitrogenous Component, Lipid, Polyphenol etc. d) Micronutrient Contents of alcoholic beverages – Vitamin, Minerals, Functional Elements, Phytochemical in wine, beer & Spirit & Liqueurs	4 2 6 6
II	A) Metabolism of alcohol – Alcohol Catabolism By Alcohol dehydrogenase, Alcohol Catabolism By MEOS i.e., Microsomal Ethanol oxidizing system &By Catalase enzyme B) Harmful Effects of excessive alcohol intake – Accident & Injuries, Alcohol Addiction, Cardiovascular Complication, gastro-intestinal disorder, liver problem, methanol & higher alcohol toxicity, nervous system and psychological disorder. Wine and allergies and hypersensitivity, headaches and dental erosion C) Emerging research on mealtime alcoholic consumption	5 12 1

References:

1. Andrea, Schaffer -Red wine for your health
2. Bruce Zoecklein, Kenneth Fugelsang, Barry Gump– Wine analysis and production
3. Buglass, Alan J.- Handbook of alcoholic beverages technical, analytical and nutritional aspects vol.1 and vol .2
4. C. A. Crampton –"Fermented Alcoholic Beverages, Malt Liquors, Wine and Cider
5. Catherine,Cheze, Joseph Vercauteren, R. Verpoorte, – Polyphenols, wine and health.
6. Ron S. Jackson. –Wine science

Semester: VI

WBAT-364 Maturation and Aging of Wine, Beer and Alcohol (2 Credit course)
Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**Whisky maturation and cask types :** a) Various cooperage oak wood use in whisky maturation. b) Cask manufacture –timber processing, Bourbon cask construction, control of heat treatment, cask regeneration oak c) Oak Chemistry & whisky maturation –Wood – derived aromas, Reaction affecting distillate components, Factor affecting whisky maturation d) Maturation – warehouse. maturation time fill strength	 3 6 6 3
II	**A) Wine aging :** a) Objective of wine aging b) Chemical reaction occurring during wine aging c) Extraction of phenolic compound from oak d) Factors affecting aging of wine e) Bottle wine maturation **B) Beer maturation :** a) Objectives of Aging and Finishing, Component Processes b) Flavor Maturation – Introduction, various important Flavor Compounds in beer	 2 3 2 3 2 2 4

References:

1. Barter, E. Denis& Hughes, Pall S.- Beer: quality safety and nutritional aspects
2. Fergus G. Priest and Graham G. Stewart – Handbook of brewing
3. Goyon, P. Ribereau, Dubouraiell, D, & Lonvaud, A.- Handbook of enology: The microbiology of wine and vinifications
4. Geoffrey, Schahinger & Bryce, Ranke- Cooperage for winemakers: A Manuel on the construction maintenance and use of oak Barrels
5. Hornesey, Tan S.- Brewing: the royal of chemistry
6. Ribereall, P. & Golries,.- Handbook of enology: the chemistry of wine stabilization and treatments

Semester: VI

WBAT-365 Alcohol Marketing Law and Regulatory Policies (2 Credit course)
Total No. of lectures =36

Credit	Topics	No. of Hours
I	**A) Introduction and Background of Wine, Beer and Alcohol Industry**	3
	B) Legal Environment	3
	C) State Excise Policies and Revenue System across various States in India a) Licensing b) Restrictions c) MLDA d) Ban on Advertising, Promotion and Sponsorship	4
	D) Detailed Study of Alcohol laws a) Legal laws for people in India and Worldwide. b) Legal laws for Breweries, Wineries and Distilleries in India and worldwide. c) Taxation related to alcohol in India and Worldwide.	4
	E) Introduction to Advertising Standards Council of India (ASCI) a) What is ASCI? b) Role of the Advertising Standards Council of India (ASCI)	4
II	**A) Law related to Alcohol Marketing on Digital Media**	3
	B) Overview on Goods and Service Tax	2
	C) Patent **a)** Introduction and Importance of Patenting, **b)** Laws regarding Patenting **c)** Types of Patents and their importance	5
	D) Cross border business laws for alcohol Industry. a) Introduction to shipping and logistics and its process. b) Alcohol Shipment Procedure from India throughout the world c) International Business related to alcohol Industry.	4
	E) Laws related to Illicit Alcohol in India **a)** Meaning of illicit alcohol. **b)** Different laws of different states of India. **c)** Different laws and punishment for illegal alcohol making and trading in India and worldwide	4

References:

1. Adarsh, Ramaunjan- Patent law cases and materials: a synthesis for India
2. Manual from Government of Maharashtra, State Excise Department Vol-I
3. Richard, Stim- Patent,copyright& trademark: an intellectual property desk
4. Paul Wagner, Janeen Olsen, and Liz Thach- Wine marketing & sales
5. Philip, Kotler- Marketing management
6. Russell, Jesse- Alcohol laws in India
7. Sheetal Chopra- A book on Indian patenting system and patent agent examination

Semester: VI

WBAT- 366 Wine Technology -III (2 Credit course)
Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**The production of sparkling wines** a) Preparation of base wine: Harvesting, pressing, juice treatments, fermentation (primary and secondary) b) Base wine storage and selection c) Assemblage and Triage addition d) Riddling, Disgorging and Liquoring process e) Alternative process for the large-scale production of sparkling wine: The transfer process, Tank Process and Carbonation.	 4 1 1 2 10
II	**A) The Art and secret of winemaking** a) Terroir makes the quality of wine b) Chemical Constituents of Wines and Grapes c) The secret of making wine and art of winemaker: Study on barrel and oak characteristics d) New trends in the world of wine: Screw caps vs Cork **B) Post fermentation process** a) Tartrate stability in wine b) Protein stability in wine c) Colloidal stability in wine d) Immobilized agent for wine treatment e) Other winemaking process: rosé and sweet wine style	 1 2 2 1 2 2 2 1 5

Reference Book-

1. Armstrong, David, Rankine, Bryce & Linton, Geoff- Sparking wines : the technology of their production in Australia
2. Bernard Gautier - Practical aspects of wine filtration
3. Concepts of wine chemistry
4. Geoffrey, Schahinger& Bryce, Ranke- Cooperage for winemakers : a Manuel on the construction maintenance and use of oak Barrels
5. Goyon, P., Ribereau, Dubouraiell, D,&Lonvaud, A.- Handbook of enology Vol. 1: the microbiology of wine and vinifications
6. Jackson, Ron S. - Wine science
7. P. Rabereau- Hand book of enology-Vol.2: the chemistry of wine stabilization & treatments
8. Ribereall, P. &Golries, Gayan Y.- Handbook of enology vol. 2: the chemistry of wine stabilization and treatments
9. Vine, Richard P.-Wine science: principles, practice perception

Semester: VI

WBAT- 367: Practical's course –I (2 Credit Course)

Sr No	Experiment Title	No. of Practicals
1	Calculate BOD of given sample(waste water /winery effluent)	1
2	Calculate COD of given sample(waste water /winery effluent)	1
3	To determine the TSS and TDS from the given sewage sample	1
4	Confirmed test of coliform bacteria and Completed test for coliform bacteria	1
5	The organization of wine evaluation: the space, equipment, temperature, order of serving the wines	1
6	Performing and methods of sensory assessment (pair, three-angel, duo-trio test, the differentiation test, ranking test hedonic rating test and description analysis).	1
7	Perform sensory evaluation of beer	1
8	Perform sensory evaluation of wine and scoring it	1
9	Analysis of substances responsible for astringency, bitterness	1
10	Expression of senses perception (vocabulary); the types and methods of Evaluation and the sensory evaluation by aroma wheel (varietal aroma, flavour and wood)	1
11	Perform bitterness and sweetness balance on palate of given faulty wine	1
12	Basics of wine and food pairing bases on sweetness, acidity, texture, tannin levels, oiliness and spice characteristics.	1

Semester: VI

WBAT- 368 : Practical's course – II (2 Credit Course)

Sr No	Experiment Title	No. of Practicals
1	Identify the type of haze formed in wines: proteins, pectin and glucans	1
2	The art of blending wine	1
3	Qualitative test for Chlorine	1
4	To determine the moisture content and sterility of cork and Sterility checking of bottled wines	1
5	Determination of total sugar as invert sugar in final molasses	1
6	Lab trial of molasses /starch based fermentation in distillery	1
7	Determination of volatile acids of molasses	1
8	Determine reducing sugar of wine by rebelein method	1
9	Determination of Specific Gravity & Extract of wort.	1
10	Determine the protein content of given wine /beer by lowry/ biuret method	1
11	Estimation of alcohol content of beer by hydrometer and specific gravity method	1
12	Visit to winery/brewery /distillery	1

Semester: VI

WBAT - 369: Project Based On Wine or Beer or Alcohol Technology (in house) (2 Credit Course)

Short term research project

The Opportunity to analyze a particular industry based problem or topic in depth. Conduct a relevant lab or library- based study. To provide a chance to improve fundamental research & analysis, skills & advance understanding of then processes involved in Wine technology, Brewing technology or Alcohol technology

Project work, Thesis Submission & presentation

- Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department./Research Institute/Industry
- Project work / Thesis / Dissertation shall be pursued for a minimum of 12 weeks during the final semester.
- The Project Report/Thesis / Dissertation report is to be prepared as per standard scientific research methodology and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.
- The assessment (Internal and external) of the project work will be as per SPPU guidelines.

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Semester: VI

Skill Enhancement Course

WBAT- 3610 Brewing technology -II (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A)Yeast handling :-** a) Yeast species used in brewing, yeast cell structure, ale and lager yeast. b) Yeast management: -Yeast propagation –in laboratory and in brewing plant and storage of yeast stock culture between propagation, yeast collection ,yeast storage, yeast washing c) Post-fermentation treatment of yeast, Yeast Crop, yeast treatment after cropping and its storage,	3 10 5
II	**A) Beer production :-** Process initialization a) Milling of malt and adjuncts – in detail study of process. b) Mashing - in detail study of process ,biochemical changes during mashing c) Lautering– Lauter tun ,wort filtration and composition of wort d) Wort boiling -– in detail study of process e) Wort aeration and wort colling -– in detail study of process	3 3 4 4 4

References :

1. Barter, E. Denis and Hughes, Pall S.- Beer: quality safety and nutritional aspects
2. Harnesey, Tan S.- A history of beer & brewing
3. Hieronymus, Stan- Hops
4. Hornesey, Tan S.(1999). Brewing: the royal of chemistry
5. Johnmallett-Malt a practical guide from field to brewhouse
6. Johnpalmer- Water a comprehensive guide for brewers
7. lewis, Michel J. and Young, Tom W.- Brewing
8. Priest, Fergus G. and Stewart Graham G.- Handbook of brewing
9. Stevendeeds- Brewing engineering
10. White, Chris and Jamilzaiansheff -Yeast: the practical guide to beer fermentation

Semester: VI

Skill Enhancement Course

WBAT- 3611 Alcohol technology - II (2 Credit course)

Total No. of lectures =36

Credit	Topics	No. of Lectures
I	**A)Basics of alcoholic beverages :** a) History of alcoholic beverages in India b) Overview of Indian alcoholic beverages market c) Outline of Indian whisky production d) Distillation - Definition & distillation fundamentals -- Raults law, Dalton's law, volatility, Relative volatility, Rectification and stripping section, typical distillation system with diagram. e) Distillation types --Simple distillation, batch distillation, continuous distillation	2 2 4 4 6
II	**A)Scotch whisky production-** a) Raw material for malt distilling b) Barley procurement &malting Beating, Malt specification c) Raw material for grain distilling i.e Wheat- biochemistry & Physiology of wheat , wheat specifications ,Concept of gelatinization, starch hydrolysis d) Flowchart of malt distillery flow chart of typical grain distillery e) Malt processing :- Milling – principle , process i.e. Roller & Hammer milling f) Mashing: --- objective of mashing, working Process & types of mash tun used. **B) Effluent in Distillery** a) Introduction to Effluent of Distillery b) Need for effluent treatment of distillery waste c) Pollution-General overview, Types of pollution	1 2 3 3 2 3 1 1 2

Reference Book:

1. Barron, H.C.- Distillation
2. Chatterjee, A.C.- Handbook of fermentation & distillation
3. Inge Russell and graham-Whisky: technology, production and marketing
4. Jacques, T. P. Lyons & D. R. Kelsall- The alcohol textbook
5. Paturao- Byproducts of sugar industry
6. Satyanarayana, Rao- Alcoholometry
7. Technical Excise Manual