
Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
(Affiliated to Savitribai Phule Pune University, Pune)



Choice Based Credit System (CBCS)
Framework for Syllabus

Bachelor of Science (B. Sc.) in
WINE TECHNOLOGY

Implemented from
Academic year 2023-24

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

Semester – I

Course Type	Course Code	Course Title	Credits
DSCC- 01	BSC-WBAT 101T	Basic Microbiology I	02
DSCC- 02	BSC-WBAT 102T	Industrial Microbiology I	02
DSCC- 03	BSC-WBAT 103T	Basic Botany	02
DSCC- 04	BSC-WBAT 104T	Plant Development and Anatomy	02
DSCC- 05	BSC-WBAT 105T	Basic Biochemistry I	02
DSCC- 06	BSC-WBAT 106T	Computer Applications	02
DSCC- 07	BSC-WBAT 107T	Basic Oenology	02
DSCC- 08	BSC-WBAT 108T	Sensory Evaluation of wine I	02
DSPC- 01	BSC-WBAT 109P	Practical's in Microbiology	1.5
DSPC- 02	BSC-WBAT 110P	Practical's in Botany	1.5
DSPC- 03	BSC-WBAT 111P	Practical's in Biochemistry and Computer application	1.5
DSPC- 04	BSC-WBAT 112P	Practical's in Oenology	1.5
		Total Credits	22

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

Semester – II

Course Type	Course Code	Course Title	Credits
DSCC- 09	BSC-WBAT 201T	Basic Microbiology II	02
DSCC- 10	BSC-WBAT 202T	Industrial Microbiology II	02
DSCC- 11	BSC-WBAT 203T	Plant Physiology	02
DSCC- 12	BSC-WBAT 204T	Applied Botany	02
DSCC- 13	BSC-WBAT 205T	Basic Biochemistry II	02
DSCC- 14	BSC-WBAT 206T	Metabolic Pathways	02
DSCC- 15	BSC-WBAT 207T	Introduction to Beer, Wine and Alcohol Technology	02
DSCC- 16	BSC-WBAT 208T	Sensory Evaluation of Wine-II	02
DSPC- 05	BSC-WBAT 209P	Practical's in Microbiology	1.5
DSPC- 06	BSC-WBAT 210P	Practical's in Botany	1.5
DSPC- 07	BSC-WBAT 211P	Practical's in Biochemistry	1.5
DSPC- 08	BSC-WBAT 212P	Practical's in Wine Technology	1.5
		Total Credits	22

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

Semester –III

Course Type	Course Code	Course Title	Credits
DSCC- 17	BSC-WBAT 301T	Fermentation Technology I	02
DSCC- 18	BSC-WBAT 302T	Yeast Technology	02
DSCC- 19	BSC-WBAT 303T	Brewing Technology	02
DSCC- 20	BSC-WBAT 304T	Alcohol Technology	02
DSCC- 21	BSC-WBAT 305T	Applied Biochemistry	02
DSCC- 22	BSC-WBAT 306T	Vineyard Management I	02
DSPC- 09	BSC-WBAT 307T	Practical's Course -I	02
DSPC- 10	BSC-WBAT 308T	Practical's Course -II	02
DSPC- 11	BSC-WBAT 309P	Practical's Course -III	02
AECC- I - EVS	BSC-WBAT 310T	AECC-I Critical Thinking and Scientific Temper	02
AECC-02- LC	BSC-WBAT311T	AECC-II Language and Communication I	02
GE-01(A) GE-01(B)	BSC-WBAT312(A)T BSC-WBAT312(B)T	Food Technology Laboratory Management	02
GE-01(A) GE-01(B)	BSC-WBAT313(A)P BSC-WBAT313(B)P	Practical's in Food Technology Practical's in Laboratory management	02
		Total Credits	26

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

Semester – IV

Course Type	Course Code	Course Title	Credits
DSCC- 23	BSC-WBAT 401T	Fermentation Technology II	02
DSCC- 24	BSC-WBAT 402T	Fruit and Fortified Wines	02
DSCC- 25	BSC-WBAT 403T	Wine Technology I	02
DSCC- 26	BSC-WBAT 404T	Wine Technology II	02
DSCC- 27	BSC-WBAT 405T	Business Management	02
DSCC- 28	BSC-WBAT 406T	Vineyard Management II	02
DSPC- 12	BSC-WBAT 407P	Practical's Course -I	02
DSPC- 13	BSC-WBAT 408P	Practical's Course -II	02
DSPC- 14	BSC-WBAT 409P	Practical's Course -III	02
AECC - I - EVS	BSC-WBAT 410T	AECC-III Environment science	02
AECC-02- LC	BSC-WBAT 411T	AECC-IV Language and Communication II	02
GE-02(A)	BSC-WBAT 412(A)T	Biophysical and Biochemical techniques	02
GE-02(B)	BSC-WBAT 412(B)T	Plant tissue culture	
GE-02(A)	BSC-WBAT 413(A)P	Exercises in Biophysical and Biochemical	02
GE-02B)	BSC-WBAT 413(B)P	technique	
(Practical)		Practical's in Plant tissue culture	
		Total Credits	26

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

Semester –V

Course Type	Course Code	Course Title	Credits
DSCC- 15	BSC-WBAT 501T	Basic Chemical Engineering	02
DSCC- 16	BSC-WBAT 502T	Equipment and Utilities	02
DSCC- 17	BSC-WBAT 503T	Health Benefits of Alcoholic Beverages I	02
DSCC- 18	BSC-WBAT 504T	Microbial Spoilage and Defects in Alcoholic Beverages	02
DSCC- 19	BSC-WBAT 505T	Marketing of Alcoholic Beverages	02
DSCC- 20	BSC-WBAT 506T	Waste Treatment I	02
DSPC- 15 Practical	BSC-WBAT 507P	Practical Course -I	02
DSPC- 16 Practical	BSC-WBAT 508P	Practical Course -II	02
DSPC- 17 Practical	BSC-WBAT 509P	Practical Course -III	02
SEC -01 *	BSC-WBAT 510T	Scientific Writing and Communication	02
SEC - 02 Practical *	BSC-WBAT 511Pr	Summer Industrial Internship/Project (Brewery/Distillery/Viticulture project) Report Writing and presentation	02
		Total Credits	22

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

Semester –VI

Course Type	Course Code	Course Title	Credits
DSCC- 21	BSC-WBAT 601T	Brewing and Alcohol Technology	02
DSCC- 22	BSC-WBAT 602T	Sensory Evaluation of Wine, Beer and Alcohol	02
DSCC- 23	BSC-WBAT 603T	Health benefits of Alcoholic Beverages- II	02
DSCC- 24	BSC-WBAT 604T	Maturation and Aging of Alcoholic Beverages	02
DSCC- 25	BSC-WBAT 605T	Alcoholic Beverages: Laws and Regulatory Policies	02
DSCC- 26	BSC-WBAT 606T	Waste Treatment II	02
DSPC- 18 Practical	BSC-WBAT 607P	Practical Course -I	02
DSPC-19 Practical	BSC-WBAT 608P	Practical Course -II	02
DSPC- 20 Practical	BSC-WBAT 609P	Practical Course III	02
SEC -3*	BSC-WBAT 610	Enzyme Technology	02
SEC - 4 Project*	BSC-WBAT 611Pr	Winter Industrial Internship/Project (Distillery/Winery) Report Writing and Presentation	02
		Total Credits	22

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Choice Based Credit System (CBCS)

Bachelor of Science (B. Sc.)

Syllabus of

T. Y. B. Sc. Wine Technology

Implemented from
Academic year 2023 -24

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)

Board of Studies in Wine Technology

Sr. No.	Name	Designation
1.	Dr. Sanjay Tukaram Moharekar	Chairman
2.	Dr. Shubhangi Sanjay Moharekar	Member
3.	Dr. Sarika Ramesh Rao Deshmukh	Member
4.	Mr. Ashish Sadanand Wani	Member
5.	Prof. Syed S. Dastager	Vice-Chancellor Nominee
6.	Prof. Sanjay V. Patil	Academic Council Nominee
7.	Mr. Rajendra G. Chaurse	Academic Council Nominee
8.	Mr. Prasad Vinod Rajale	Alumni
9.	Mr. Manoj Madhukarrao Mukkirwar	Industry Expert
10.	Ms. Dipali D. Giramkar	Member (co-opt)
11.	Ms. Supriya P. Salve	Member (co-opt)

Prologue/ Introduction of the programme:

Wine, Beer and Alcohol 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.

2. Programme Outcomes (POs)

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 manpower.

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 student's build-up a progressive and successful career

Programme Structure and Course Titles

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1.	F. Y. B. Sc.	I	BSC-WBAT 101T	Basic Microbiology I	02
2.	F. Y. B. Sc.	I	BSC-WBAT 102T	Industrial Microbiology I	02
3.	F. Y. B. Sc.	I	BSC-WBAT 103T	Basic Botany	02
4.	F. Y. B. Sc.	I	BSC-WBAT 104T	Plant Development and Anatomy	02
5.	F. Y. B. Sc.	I	BSC-WBAT 105T	Basic Biochemistry I	02
6.	F. Y. B. Sc.	I	BSC-WBAT 106T	Use of Computer	02
7.	F. Y. B. Sc.	I	BSC-WBAT 107T	Basic Oenology	02
8.	F. Y. B. Sc.	I	BSC-WBAT 108T	Sensory Evaluation of wine I	02
9.	F. Y. B. Sc.	I	BSC-WBAT 109P	Practical's in Microbiology	1.5
10	F. Y. B. Sc.	I	BSC-WBAT 110P	Practical's in Botany	1.5
11	F. Y. B. Sc.	I	BSC-WBAT 111P	Practical's in Biochemistry and Computer application	1.5
12	F. Y. B. Sc.	I	BSC-WBAT 112P	Practical's in Oenology	1.5
13	F. Y. B. Sc.	II	BSC-WBAT 201T	Basic Microbiology II	02
14	F. Y. B. Sc.	II	BSC-WBAT 202T	Industrial Microbiology II	02

15	F. Y. B. Sc.	II	BSC-WBAT 203T	Plant Physiology	02
16	F. Y. B. Sc.	II	BSC-WBAT 204T	Applied Botany	02
17	F. Y. B. Sc.	II	BSC-WBAT 205T	Basic Biochemistry II	02
18	F. Y. B. Sc.	II	BSC-WBAT 206T	Metabolic Pathways	02
19	F. Y. B. Sc.	II	BSC-WBAT 207T	Introduction to Beer, Wine and Alcohol Technology	02
20	F. Y. B. Sc.	II	BSC-WBAT 208T	Sensory Evaluation of Wine-II	02
21	F. Y. B. Sc.	II	BSC-WBAT 209P	Practical's in Microbiology	1.5
22	F. Y. B. Sc.	II	BSC-WBAT 210P	Practical's in Botany	1.5
23	F. Y. B. Sc.	II	BSC-WBAT 211P	Practical's in Biochemistry	1.5
24	F. Y. B. Sc.	II	BSC-WBAT 212P	Practical's in Wine Technology	1.5
25	S. Y. B. Sc.	III	BSC-WBAT 301T	Fermentation Technology I	02
26	S. Y. B. Sc.	III	BSC-WBAT 302T	Yeast Technology	02
27	S. Y. B. Sc.	III	BSC-WBAT 303T	Brewing Technology	02
28	S. Y. B. Sc.	III	BSC-WBAT 304T	Alcohol Technology	02
29	S. Y. B. Sc.	III	BSC-WBAT 305T	Applied Biochemistry	02
30	S. Y. B. Sc.	III	BSC-WBAT 306T	Vineyard Management I	02
31	S. Y. B. Sc.	III	BSC-WBAT 307T	Practical's Course -I	02
32	S. Y. B. Sc.	III	BSC-WBAT 308T	Practical's Course -II	02
33	S. Y. B. Sc.	III	BSC-WBAT 309P	Practical's Course -III	02
34	S. Y. B. Sc.	III	BSC-WBAT 310T	AECC-I Critical Thinking and Scientific Temper	02
35	S. Y. B. Sc.	III	BSC-WBAT311T	AECC-II Language and Communication I	02
36	S. Y. B. Sc.	III	BSC-WBAT312(A)T BSC-WBAT312(B)T	Food Technology Laboratory management	02
37	S. Y. B. Sc.	III	BSC-WBAT313(A)P BSC-WBAT313(B)P	Practical's in Food Technology Practical's in Laboratory management	02
38	S. Y. B. Sc.	IV	BSC-WBAT 401T	Fermentation Technology II	02
39	S. Y. B. Sc.	IV	BSC-WBAT 402T	Fruit and Fortified Wines	02

40	S. Y. B. Sc.	IV	BSC-WBAT 403T	Wine Technology I	02
41	S. Y. B. Sc.	IV	BSC-WBAT 404T	Wine Technology II	02
42	S. Y. B. Sc.	IV	BSC-WBAT 405T	Business Management	02
43	S. Y. B. Sc.	IV	BSC-WBAT 406T	Vineyard Management II	02
44	S. Y. B. Sc.	IV	BSC-WBAT 407P	Practical's Course -I	02
45	S. Y. B. Sc.	IV	BSC-WBAT 408P	Practical's Course -II	02
46	S. Y. B. Sc.	IV	BSC-WBAT 409P	Practical's Course -III	02
47	S. Y. B. Sc.	IV	BSC-WBAT 410T	AECC-III Environment science	02
48	S. Y. B. Sc.	IV	BSC-WBAT 411T	AECC-IV Language and Communication II	02
49	S. Y. B. Sc.	IV	BSC-WBAT 412(A) BSC-WBAT 412(B)	Biophysical and Biochemical techniques Plant tissue culture	02
50	T. Y. B. Sc.	V	BSC-WBAT 501T	Basic Chemical Engineering	02
51	T. Y. B. Sc	V	BSC-WBAT 502T	Equipment and Utilities	02
52	T. Y. B. Sc	V	BSC-WBAT 503T	Health Benefits of Alcoholic Beverages I	02
53	T. Y. B. Sc	V	BSC-WBAT 504T	Microbial Spoilage and Defects in Alcoholic Beverages	02
54	T. Y. B. Sc	V	BSC-WBAT 505T	Marketing of alcoholic beverages	02
55	T. Y. B. Sc	V	BSC-WBAT 506T	Waste Treatment I	02
56	T. Y. B. Sc	V	BSC-WBAT 507P	Practical Course -I	02
57	T. Y. B. Sc	V	BSC-WBAT 508P	Practical Course -II	02
58	T. Y. B. Sc	V	BSC-WBAT 509P	Practical Course -III	02
59	T. Y. B. Sc	V	BSC-WBAT 510T	Scientific Writing and Communication	02
60	T. Y. B. Sc	V	BSC-WBAT 511Pr	Summer Industrial Internship/Project (Brewery/Distillery/Viticulture) Report Writing and presentation	02
61	T. Y. B. Sc	VI	BSC-WBAT 601T	Brewing and Alcohol Technology	02
62	T. Y. B. Sc	VI	BSC-WBAT 602T	Sensory Evaluation of Wine, Beer	02

				and Alcohol	
63	T. Y. B. Sc	VI	BSC-WBAT 603T	Health benefits of Alcoholic Beverages-II	02
64	T. Y. B. Sc	VI	BSC-WBAT 604T	Maturation and Aging of Alcoholic Beverages	02
65	T. Y. B. Sc	VI	BSC-WBAT 605T	Alcoholic Beverages: Laws and Regulatory Policies	02
66	T. Y. B. Sc	VI	BSC-WBAT 606T	Waste Treatment II	02
67	T. Y. B. Sc	VI	BSC-WBAT 607P	Practical Course -I	02
68	T. Y. B. Sc	VI	BSC-WBAT 608P	Practical Course -II	02
69	T. Y. B. Sc	VI	BSC-WBAT 609P	Practical Course III	02
70	T. Y. B. Sc	VI	BSC-WBAT 610T	Enzyme Technology	02
71	T. Y. B. Sc	VI	BSC-WBAT 611Pr	Winter Industrial Internship/Project (Distillery/Winery) Report Writing and Presentation	02
	Total	06	71		140

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
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Syllabus of T.Y. B.Sc. Wine, Brewing and Alcohol Technology
under
Faculty of Science and Technology

Semester – V	
Course Code: BSC-WBAT 501T	Title of the Course: Basic Chemical Engineering
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will be able to understand the fundamental properties of fluid.
- b. Students will be able to understand behavior under various conditions of internal and external flow of fluids.
- c. Students will understand the refrigeration system.
- d. Students will be able to study the different types of heat exchangers.

Detailed Syllabus:

Unit I: Basic fluid flow and fluid mechanics: (08)

Fluid, branches of fluid mechanics, properties of fluid, classification of fluids, Newton's law of viscosity, numerical, Newtonian and non-newtonian fluids, types of flow, viscometers. Basic equations of fluid flow: continuity equation and equation of motion, flow measurement using venturi meter, orifice meter, pitot's tube, rotameter, magnetic flowmeter. Pump selection and performance: characteristic diagrams of pumps, net positive suction head, computation of pump requirements.

Unit II: Energy for wine processing (08)

Steam generation: steam generation systems, thermodynamics of phase change, steam tables, steam utilization. Electric power utilization: electrical terms and units, Ohm's law, electric circuits, electric motors, electrical control.

Unit III: Heat Transfer and Thermal Processing (08)

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. Thermal processing: Decimal reduction time (D), thermal resistance constant (z), thermal death time (F), relationship between chemical kinetics and thermal processing parameters:

decimal reduction time, rate constants and thermal resistance constant, activation energy E_a and their inter-relationship.

Unit IV: Refrigeration

(06)

Selection of refrigerants, components of refrigeration system (evaporator, compressor, condenser and expansion valve).

Basic design of chilling systems, calculation of heat loads.

Suggested Readings:

1. Chatwal, Gurdeep P.& Anand, Sham, 2011, Instrumental Methods of chemical Analysis, Himalaya Publication house.
2. Liptak, Bela G. 1993, Flow measurements, CRC Press.
3. Frank E. Jones 1995 Techniques and Topics in Flow Measurement CRC Press
4. McCabe, Warren L., Smith, Julian C. & Harriott, Peter 2017, 7th edition -Unit operations of chemical engineering, McGraw Hill Education.
5. D G Peacock, J.F. Richardson 1994, 3rd Edition, Chemical Engineering, Butterworth-Heinemann.
6. Kulkarni A. P. 2015, 2nd edition Chemical Engineering Fluid Mechanics Nirali Publication, ISBN: 9789351646792, 9351646793

Semester – IV	
Course Code: BSC-WBAT 502T	Title of the Course: Equipment and Utilities
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will understand importance of utility services of winery and brewery.
- b. Students will study the lab equipments.
- c. Students will understand different instruments used for sanitization in winery and brewery.
- d. Students will able to understand basic design of different equipments used in winery and brewery.

Detailed Syllabus:

Unit I: Required utility services: (07)

Water–Various water sources, Hardness and need for softening, water pressure requirements, hot water needs and systems.

Electric supply–Power supply requirement to run various equipment’s, air-conditioning, humidifiers, dehumidifiers, chilling system.

Unit II: Industrial equipments: (08)

Functions, types and uses of Sorting tables, receivers/hoppers, pneumatic press, destemmers and crushers, basket press. Heat exchangers: plate heat exchanger and 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.

Unit III: Winery and brewery sanitization: (08)

Functions, types and uses of pressure cleaners, spray nozzles, airlocks, pest controllers, bottling, filtration systems, CIP systems.

Unit IV: Special lab equipments: (07)

Functions, types, and uses of Ebulliometer, centrifuge, dissolved oxygen meter, torque tester, colorimeter, oven, pressure checking equipment, spectrophotometer, bottling machines, fillers, corking machines, screw cappers, labeling machines.

Suggested Readings:

1. Buglass, Alan J. 2011, volume 2, Handbook of alcoholic beverages technical analytical and nutritional aspects, Wiley.
2. David, Bird and Hugh Johnson 2011, 3rd edition, Understanding wine technology
3. David, Storm R. 2001, Winery utilities: planning, design and operation.
4. Liptak, Bela G. 1994, Analytical instruments, Routledge.
5. Roger, B. Boulton, and Vernon Singleton 1999, Principle and practices of winemaking, Springer.

Semester – V	
Course Code: BSC-WBAT 503T	Title of the Course: Health Benefits of Alcoholic Beverages I
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will study the health benefits of different alcoholic beverages.
- b. Students will be able to understand importance of antioxidants.
- c. Students will understand role of antioxidants in prevention of different diseases.
- d. Students will be able to understand benefits of moderate wine consumption.

Detailed Syllabus:

Unit I: Antioxidants: (12)

Basic concept of antioxidant and free radical, Types of free radicals (reactive oxygen species and reactive nitrogen species), free radical and cell damage, mechanism of action of antioxidants

Wine polyphenols as antioxidant and free radical scavengers

Major wine antioxidants- procyanidins, salicylic acid, dihydroxy butyrate, epicatechin, gallic acid, quercetin and resveratrol

French paradox and protective effect of moderate alcohol consumption, synergism of alcohol and antioxidant in wine

Unit II: Moderate alcohol consumption and associated health benefits: (18)

Moderate alcohol consumption and associated health benefits-To liver, lungs, heart, anti-ageing effect, reduction in various causes of mortality, ulcers, kidney stone, use of alcohol in treatment of fever and as antiseptic etc.

Role of antioxidant in preventing-cardiovascular disease, cancer, gout, anti-degenerative disease-Parkinson's Disease, Alzheimer's Disease, rheumatoid arthritis, fetal alcohol syndrome, antimicrobial effect of alcohol, allergies and hypersensitivity

Suggested Readings:

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1. Andrea and Schaffer (2001) Red wine for your health, ISBN : 1553560019, Key Porter Books Ltd
 2. Zoecklein B., Fugelsang K. and Gump B. (1995) Wine analysis and production, 1st edition, Hardcover ISBN 978-0-412-98241-5, Zoecklein, Springer, Boston
 3. Buglass J. Alan J. (2010) Handbook of alcoholic beverages technical, analytical and nutritional aspects, vol.1 and Vol .2, ISBN:9780470512029, John Wiley & Sons, Ltd
 4. C. A. Crampton (1887) Fermented Alcoholic Beverages, Malt Liquors, Wine and Cider, Government Printing Office, Washington
 5. Catherine, Cheze, Vercauteren J. and R. Verpoorte (2001) Polyphenols, wine and health , ISBN: 978-94-015-9644-2, Proceedings of the Phytochemical Society of Europe, Bordeaux, France
 6. Jackson R. S. (2008) Wine science-Principles and applications, 3rd edition, ISBN 978-0-12-373646-8, Elsevier Inc.

Semester – V	
Course Code: WBAT-504T	Title of the Course: Microbial Spoilage and Defects in Alcoholic Beverages
Credits: 2	Total Hours: 30

Course Outcomes (COs):

- a. Students will study the microorganisms responsible for wine spoilage.
- b. Students will learn characteristics of spoiled wine.
- c. Students will know strategies for controlling wine spoilage.
- d. Students will study wine and beer defects.

Detailed Syllabus:

Unit I: Microbial spoilage: 05

Introduction to microbial spoilage, Origin of wine spoilage microorganisms, General features of spoilage microorganisms-yeast and bacteria, Identification of wine spoilage microorganisms.

Wine microbial spoilage and its control: 15

Faults caused by yeast and molds, Faults caused by acetic acid bacteria, Faults caused by Lactic acid bacteria (LAB)-bitterness taint, diacetyl taint, geranium taint, ropiness, mannitol taint, mousiness, re-fermentation etc.

Faults caused by other aerobic bacteria and cork induced spoilage, Killer factor- killer yeast, toxins, significance of killer yeast in wine making, Control of microbial spoilage.

Unit II: Wine defects: 10

Wine defects-origin and remedies

Concept of defect, defining flaws and faults, flaws appearance, Oxidation- defect caused by acetaldehyde, acetic acid

Defect caused by sulphur compound-sulphuroxides, hydrogen sulphide, mercaptans, dimethyl sulphide etc.

Study of various practical techniques to solve defects during processing-phenolic wines-harsh and drying tannins, deacidification, acidification, dealing with stuck fermentation.

Additives allowed in making wine: Study of compounds and levels listed by OIV, AWRI and BIS.

Beer defects-causes and effect

5

Oxidation and staling of beer, Foam stability, Formation of haze by polyphenol, polypeptide, calcium oxalate, carbohydrates

Microbiological contamination in beer- brewery spoilage microorganisms

Suggested Readings:

1. E. Denise Baxter & Paul S. Hughes, Beer: Quality Safety And Nutritional Aspects, 2001, Royal Society Of Chemistry, Thomas Graham House, Science Park, Milton Road , Cambridge, Uk
2. Roger B. Boulton, Vernon L. Singleton, Linda F. Bisson, Ralph E. Kunkee, Principles And Practice Of Winemaking 1996, Chapman And Hall
3. Graham H. Fleet, Harry Puspito, Wine Microbiology & Biotechnology, Applied Microbiology And Biotechnology, Vol. 22
4. John Hudelson, Wine Faults – Causes, Effects And Cures, December 2010, Wine Appreciation Guild
5. Pascal Ribéreau-Gayon, Denis Dubourdieu, Bernard B. Donèche, Aline A. Lonvaud, John Towey, Handbook Of Enology, Volume 1: The Microbiology Of Wine And Vinifications, 3rd Edition, John Wiley & Sons Ltd.
6. Iland, Patrick; Bruer, Nick; Wilkes, Eric, Chemical Analysis Of Grapes And Wine: Techniques And Concepts, 2004, Patrick Iland Wine Promotions,
7. Ronald Jackson, Wine Science: Principles And Applications (Food Science & Technology), 2020, 5th Edition, Academic Press

Semester – V	
Course Code: BSC-WBAT 505T	Title of the Course: Marketing of alcoholic beverages
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will be able to understand fundamentals of marketing.
- b. Students will learn various marketing strategies.
- c. Students will study digital marketing and advertisement.
- d. Students will learn Business Environment of Alcohol Industry.

Detailed Syllabus:

Unit I:

Introduction to Marketing: (15)

Fundamentals of Marketing, Basic Marketing Principles, 4Ps of Marketing

Fundamentals of Marketing Management:

Introduction, definition, importance and functions of Marketing Management, Henri Fayols 14 principles

Buying Behavior:

Buying Motives of Wine, Beer and Alcohol Consumers, Importance of Studying Buying Behavior, Factors influencing buying behavior, Buying Decision Process

Basics of Branding and Marketing Strategies:

Difference between Brand and Branding, Basics of Brand Positioning, Wine, Beer and Alcohol Branding

Unit II: (15)

Digital/Social Media Marketing of Alcoholic beverages:

Introduction, Importance of Digital Marketing in Beverage Industry

International Marketing:

Introduction, Types of International Marketing (Export, Franchising, Licensing, Joint Venture), International Marketing strategy.

Business Environment in Alcohol Industry

Introduction, Important Business Environmental Factor of Brewery, Winery, Distillery, SWOT Analysis technique.

Marketing Techniques used by Alcohol Industry (Advertisement Management)

Surrogate Marketing, Advertising and Importance of Advertising, Other marketing technique (Case study).

Suggested Readings:

1. Inge Russell , Graham Stewart , Charles Bamforth) (2003) Whisky: Technology, Production and Marketing (Handbook of Alcoholic Beverages) 1st Edition, United States Academic Press; 1st edition (10 July 2003).
2. Philip Kotler, Kevin Lane Keller 2009 Marketing management 13th ed Pearson Prentice Hall, Upper Saddle River, N.J.
3. Paul Wagner ,Janeen Olsen ,Liz Thach (2019) Wine marketing and sales 3rd edition San Francisco, California The Wine Appreciation Guild.

Semester – V	
Course Code: BSC-WBAT 506T	Title of the Course: Waste Treatment I
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- Students will understand water chemistry and environmental pollution
- Students will study different types of waste and its composition
- Students will study the different methods of wastewater characterization
- Students will be able to understand basic design of wastewater treatment plant
- Students will understand physical and chemical methods of wastewater treatment

Detailed Syllabus:

Unit I: Water and its pollution (14)

Water Chemistry: Introduction, hardness-types, units of hardness. Determination of hardness of water by EDTA method. Water analysis-estimation of chloride, fluoride and nitrate. Desalination of water-electro dialysis and reverse osmosis.

Concept of environmental pollution, water pollution, eutrophication, bio-accumulation and bio-magnification, introduction to wastewater, health and environment concerns, sources of wastewater, types of wastewater, industrial vs domestic wastewater, composition of wastewater (organic, inorganic and metallic constituents).

Detection of pathogenic organism of wastewater:

Index organisms of wastewater, laboratory method for detection of coli form organism by Multiple tube fermentation (MTF) technique, Membrane filter technique (MFT) technique, Colilert technique, Assessment of portability of water by Presumptive, Confirmed, Completed and Eijkman's test, techniques to distinguish fecal bacteria from non-fecal bacteria

Waste generated from fermentation industry:

Types of wastes (Solids, Liquids, Gases, Mixtures), composition, characteristics (physical, chemical and biological)

Unit II: Waste management and treatment: (16)

Waste management and treatment-objectives and regulations, Wastewater Treatment Plant Design

Physical Unit Operations: Flow measurement, Screening, Flow equalization, Mixing, Sedimentation, Accelerated gravity separation, Flotation, Granular medium filtration, Gas transfer, Volatilization and gas stripping of Volatile Organic compounds(VOCs)

Chemical Unit Processes: Chemical precipitation, Adsorption (including bio-sorption), Disinfection (chlorine, ozone and ultraviolet), Dechlorination

Suggested Readings:

1. T.D. Brock (2010), Biology of Microorganisms 13th edition, Benjamin-Cummings Pub Co.
2. R.S. Ramalho (2010), Introduction of Waste water treatment, 2nd edition, Academic Press
3. C.A. Edwards and; G.U. Veeresu (1978) “Soil Biology and; Ecology in India”, Published by University of Agricultural Sciences, Hebbal, Bangalore
4. R.K. Trivedi (2007), Environmental and Industrial Pollution control. Vol. I , Akashdeep Publishing House
5. Technical EIA guidance manual for distilleries (2009), Ministry of Environment and; Forest, Govt. of India
6. Management of Distillery Wastewater (2001) Central Pollution Control Board, Ministry of Environment and; Forest

Semester – V	
Course Code: BSC-WBAT 507P	Title of the Course: Practical Course -I
Credits: 2	Total Practical Hours: 45 Hrs.

Course Outcomes (COs):

- a. Students will able to understand basic design of different equipments used in winery and brewery.
- b. Students will study the lab equipments.
- c. Students will learn the properties of different fluids.
- d. Students will learn design and principle of chilling instruments.

Detailed Syllabus:

Sr. No.	Title of the practical	No. of Practicals
1.	Measurement of viscosity of liquids using capillary tube viscometer.	1
2.	Measurement of flow of liquids using orifice meter and venturi meter.	1
3.	Calculation of heat load, chilling plant specifications etc., using a laboratory Plate heat exchanger/shell and tube heat exchanger.	2
4.	Estimation of thermal death coefficient (k) for normal wine contaminants.	1
5.	To study the filtration of liquids through cake filters and practical calculation of refrigeration loads for wine storage.	1
6.	To study the calibration of pH meter and measurement of pH.	1
7.	Measurement of properties of liquids (must, wine, sugar syrup etc.) using specific gravity bottle and hand held refractometer.	1
8.	To study the characteristics of simple distillation.	1
9.	To study the CIP process in winery/brewery/distillery.	2
10.	Demonstration of principle and working process of ion exchange and pneumatic press.	1
11.	Demonstration of principle and working process of filtration unit.	1

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| 12. | Demonstration of principle and working process of crusher and destemmer. | 1 |
| 13. | Visit to winery/brewery/distillery | 1 |

Semester – V	
Course Code: BSC-WBAT-508P	Title of the Course: Practical Course II
Credits: 2	Total Practical Hours: 45 Hrs

Course Outcomes (COs):

- a. Students will study causes and characteristics of spoiled wine.
- b. Students will be able to isolate and identify the micro-organisms from spoiled wine.
- c. Students will practically learn the strategies for controlling wine spoilage.
- d. Students will study wine and beer defects.

Detailed syllabus:

Sr. No.	Title of the practical	No. of Practicals
1.	Study of normal flora of grape berry and leaf	2
2.	Evaluation of characteristics (haze, pH, colour, odor and taste) of spoiled wine/beer.	1
3.	Isolation, characterization and identification of microorganisms from spoiled wine samples	3
4.	Isolation, characterization and identification of microorganisms from spoiled beer samples	3
5.	Study of various strategies to solve harsh tannin defects and excessive acidity defect in wine sample	1
6.	Study of various strategies to solve excessive acidity defect in beer sample	1
7.	Case study on Microbial ecology during vinification: natural flora of grapes and other fruits, interactions of microorganisms, host-pathogen interactions	1
8.	Comparative Study on oxidized effect in champagne and white wine and i.e. oxidized wine vs. non oxidized wine and to verify the resistance of wine to air.	1
9.	To study sulfite/SO ₂ calculation for potassium metabisulfite (KMS) addition and Hygiene of grapes before and after crushing.	1
10.	Visit to vineyard, alcoholic beverage industry	1

Semester – V	
Course Code: BSC-WBAT 509P	Title of the Course: Practical Course –III
Credits: 2	Total Practical Hours: 45 Hrs.

Course Outcomes (COs):

- a. Students will understand Alcoholic Beverage Market.
- b. Students will able to understand marketing strategies.
- c. Students will study profile of Indian alcoholic beverage industries.
- d. Students will understand pricing strategy of alcoholic beverages.

Detailed Syllabus:

Sr. No.	Title of the practical	No. of Practicals
1.	To study the profiles of Indian alcohol companies and compare marketing strategies of various alcoholic brands (wine/beer/alcohol)	3
2.	To study the digital marketing/social media marketing campaign of wine/beer/liquor brand	1
3.	Case study on consumer buying behavior 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 labeling and packaging	1
6.	PowerPoint presentation on branding strategies of particular wine, beer and alcohol brands	1
7.	To develop SWOT analysis of any wine/beer/liquor brand	1
8.	To study the organization structure of winery/brewery/distillery	2
9.	To compare National and International alcoholic beverage market	1
10.	Seminar-I Marketing Management	1
11.	Seminar-II Business Management	1

Semester – V	
Course Code: BSC-WBAT510T	Title of the Course: Scientific writing and communication
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (Cos)

- a. Students will understand the concept of scientific writing.
- b. Students will learn to prepare manuscript.
- c. Students will be able to understand the guidelines for authors.
- d. Students will learn to submit the manuscript in the journals.

Detailed Syllabus:

Unit I: 10

Ethics in scientific writing, Scientific method: Concept, hypothesis, theory, law; Design of experiment; Inductive and deductive reasoning.

Project report writing:

Types of presentation: Oral, poster, written, audio-visual. Aids for presentation.

Unit II: 20

Preparing the manuscript. Guidelines for authors. The IMRAD format.

Title, byline; Abstract and Summary; Keywords.

Introduction: Defining the problem; Literature survey; Justification of study.

Materials and Methods: Contents, sources, procedures, techniques, reproducibility, Units of measurements, metric system and SI units. Basic statistical techniques, confidence limits, tests, probability, significance.

Results: Text; How to present data; Tables and illustrations. Writing captions, labels and legends. Discussion: Components and sequence. Analysis, comparison and integration of data. Likely sources of errors in Results; Conclusions and significance.

Implications for further study.

Acknowledgements. Literature citation systems. Sources of references: Journals, books, bibliographies, abstracting journals; Databases.

Preparing and submitting the manuscript. Revising, editing, proofreading.

Suggested Readings:

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1. Scientists Must Write. 2nd Edition, (2002), Barrass, R., Routledge, Oxon, UK
 2. How to Write and Publish a Scientific Paper. 6th Edition, (2006), Day, R.A. and B. A. Gastgel, Greenwood Press, Westport, CT, USA.
 3. Medical Writing: A prescription for clarity. 3rd Edition, (2006), Goodman, N.W. and M.B. Edwards, Cambridge University Press, Cambridge, UK.
 4. Planning, Proposing and Presenting Science Effectively, 2nd Edition, (2006), Hailman, J.P. and K. B. Strier, Cambridge University Press, Cambridge, UK.
 5. Bio measurement: Understanding, Analysing and Communicating Data in Biosciences, (2005), Hawkins, D., Oxford University Press, Oxford, UK.
 6. AMA Manual of Styles. A Guide for Authors and Editors, 10th Edition, (2007), JAMA and Archives Journals, Oxford University Press, New York.
 7. Successful Scientific Writing: A step-by- step guide for the biological and medical sciences, 3rd Edition, (2008), Mathews, J.R. and R.W. Mathews, Cambridge University Press, Cambridge, UK
 8. Writing Papers in the Biological Sciences. 4th Edition, (2004), McMillan, V.E., Bedford Books/St Martins.
 9. A Short Guide to Writing About Biology. 6th Edition, (2006), Pechenik, J.A., Longman, New York.

Semester – VI	
Course Code: SEC-I: BSC-WBAT-511Pr	Title of the Course: Summer Industrial Internship/Project (Brewery/Distillery/Viticulture), Report Writing and Presentation
Credits: 2	Total Hours: 45 Hrs.

Course Outcomes (Cos)

- a. Planning and execution of various research and development oriented practical's independently or as a group.
- b. Explore career alternatives prior to graduation and develop work habits and attitudes necessary for job success.
- c. Develop communication, interpersonal and other critical skills in the job interview process.

Detailed Syllabus:

It Involves Industrial internship, Laboratory/experimental/field work under the guidance of a supervisor, leading to presentation of a comprehensive report based on the experiential learning, through focused skill building activity.

The objective of this course is to help students in organization of research ideas, material, and objectives for their dissertation and development of communication skills.

After completion of this course, the students should present a detailed project report comprising of

- i. A scientific topic and relevant design of hypothesis
- ii. Aims, objective and Significance
- iii. Review of literature
- iv. Methodology/Technology used
- v. Experimental outcome and critical analysis
- vi. Summary and conclusion
- vii. References in appropriate referencing styles.

Student will submit the Project report and will be assessed as per the following guidelines.

Guidelines for assessment:

SEM V	Course	External	Internal	Contents of the Report/ Oral Presentation
	BSC-WBAT-511	35	15	<ul style="list-style-type: none">i. Topic selectedii. Aims and objective and significanceiii. Literature review (for report)iv. Plan of workv. Methodology/Technology usedvi. Results and Discussion: (Experimental outcome and critical analyses)vii. Summary and conclusionviii. References in appropriate referencing styles.
	Oral Presentation and Viva			

Semester – VI	
Course Code: BSC-WBAT 601T	Title of the Course: Brewing and Alcohol Technology
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students shall become aware of yeast management and handling.
- b. Students should be able to gain in-depth understanding of brewing.
- c. Students should be able to gain in-depth understanding of production of Indian made foreign liquor.
- d. Students should be able to know about the materials, equipments and methods used in distillation process.

Detailed Syllabus:

Unit I: Yeast management and handling: 10

Introduction to alcoholic beverages, yeast species used in production of alcoholic beverages.

Yeast management: yeast propagation in laboratory and in alcoholic beverage industry, yeast collection, yeast storage, yeast washing.

Post-fermentation treatment of yeast, yeast crop, yeast treatment after cropping and its storage.

Unit II: Production of alcoholic beverages: 10

Beer: Overview of beer production and different beer styles.

Production of Indian made foreign liquor: Raw material for malt distilling, barley procurement and malting beating, malt specification, raw material for grain distilling i.e wheat-biochemistry and physiology of wheat, wheat specifications, concept of gelatinization, starch hydrolysis, malt processing: milling-principle, process i.e. roller and hammer milling

Unit III: Distillation process: 10

Distillation-definition and distillation fundamentals: Raoult's law, Dalton's law, volatility, relative volatility, rectification and stripping section, typical distillation system with diagram. flow chart of malt distillery, flow chart of typical grain distillery.

Distillation types-simple distillation, batch distillation, continuous distillation.

Suggested Readings:

1. Barter, E. Denis and Hughes, Pall S.- Beer: quality safety and nutritional aspects
2. Harnesey, Tan S.- A history of beer and brewing

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3. Hieronymus, Stan- Hops
 4. Hornesey, TanS. (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
 11. Barron, H. C.-Distillation
 12. Chatterjee, A. C.-Handbook of fermentation and distillation
 13. Inge Russell and Graham-Whisky: technology, production and marketing
 14. Jacques, T. P. Lyons and D. R. Kelsall- The alcohol textbook
 15. Paturao-Byproducts of sugar industry
 16. Satyanarayana, Rao-Alcoholometry
 17. Technical Excise Manual

Semester – VI	
Course Code: BSC-WBAT- 602T	Title of the Course: Sensory Evaluation of Beer, Wine and Alcohol
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will study the concept of sensory evaluation.
- b. Students will be able to understand aroma wheel and flavor wheel of alcoholic beverages.
- c. Students will learn about fruit flavored liqueurs.
- d. Students will learn the sensory evaluation of spirit based alcoholic beverages.

Detailed Syllabus:

Unit I: (16)

Introduction to prerequisite of sensory evaluation laboratory, importance of sample preparation for sensory evaluation.

Beer sensory Evaluation:

Visual aspect in beer-concept of beer foam, beer foam components, foam parameter and foam structure, foam assessment, beer color and beer clarity.

Flavor determinants of beer

Taste of beer-sweetness, sourness, saltiness, bitterness

Beer aroma, Beer flavor wheel.

Liqueurs and their flavoring-basic concept of fruit and fruit flavored liqueurs, different botanicals used in liqueurs.

Unit II: Sensory evaluation of different wine types/styles: (10)

Sauvignon Blanc wine style with respect to appearance, aroma, flavors, tastes and mouth feel
 Botrytis affected sweet white wine style with respect to appearance, aroma, flavors, tastes and mouth feel.

Cabernet sauvignon wine style with respect to appearance, aroma, flavors, tastes and mouth feel.

Sherry wine style with respect to appearance, aroma, flavors and tastes and mouth feel

Champaign wine style with respect to appearance, aroma, flavors, tastes and mouth feel.

Unit III: Sensory evaluation of Spirit based alcoholic beverages (04)

Aroma taste, mouth and visual characteristics, flavor wheel.

Suggested Readings:

1. Barrass, R., (2002), *Scientists Must Write*. 2nd Edition, Routledge, Oxon, UK
2. Day, R.A. and Gastgel B. A., (2006), *How to Write and Publish a Scientific Paper*. 6th Edition, Greenwood Press, Westport, CT, USA.
3. Goodman, N.W. and Edwards M.B., (2006), *Medical Writing: A prescription for clarity*. 3rd Edition, Cambridge University Press, Cambridge, UK.
4. Hailman, J.P. and Strier K. B., (2006), *Planning, Proposing and Presenting Science Effectively*, 2nd Edition, Cambridge University Press, Cambridge, UK.
5. Hawkins, D., (2005), *Biomeasurement: Understanding, Analysing and Communicating Data in Biosciences*, Oxford University Press, Oxford, UK.
6. Mathews, J.R. and Mathews R.W., (2008), *Successful Scientific Writing: A step-by-step guide for the biological and medical sciences*, 3rd Edition, Cambridge University Press, Cambridge, UK.
7. McMillan, V.E., (2004), *Writing Papers in the Biological Sciences*. 4th Edition, Bedford Books/St Martins.
8. Pechenik, J.A., (2006), *A Short Guide to Writing About Biology*. 6th Edition, Longman, New York.

Semester –VI	
Course Code: BSC-WBAT 603T	Title of the Course: Health benefits of Alcoholic Beverages-II
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- Students will study the nutritional value of different alcoholic beverages.
- Students will understand composition of different alcoholic beverages.
- Students will learn the catabolism of alcohol.
- Students will understand harmful effects of excessive alcohol intake.

Detailed Syllabus:

Unit I: Nutritional value of Alcoholic beverages: 12

Outline of nutrient content of various alcoholic beverages-wine and cider, nutritional aspects of beer.

Macronutrient contents of alcoholic beverages, water, alcohol, carbohydrate, nitrogenous component, lipid, polyphenol etc.

Micronutrient contents of alcoholic beverages-vitamins, minerals, functional elements, phytochemicals in wine, beer and liqueurs.

Unit II: 18

Metabolism of alcohol- Alcohol catabolism by alcohol dehydrogenase, alcohol catabolism by Microsomal Ethanol Oxidizing System (MEOS) and by catalase enzyme.

Harmful effects of excessive alcohol intake- Accident and injuries, alcohol addiction, cardiovascular complication, gastro-intestinal disorder, liver problem, methanol and higher alcohol toxicity, nervous system and psychological disorder, wine and allergies and hypersensitivity, headaches and dental erosion.

Emerging research on meal time alcoholic consumption.

Suggested Readings:

- Andrea and Schaffer (2001) Red wine for your health, ISBN : 1553560019, Key Porter Books Ltd
- Zoecklein B., Fugelsang K. and Gump B. (1995) Wine analysis and production, 1st edition, Hardcover ISBN 978-0-412-98241-5, Zoecklein, Springer, Boston

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3. Buglass J. Alan J. (2010) Handbook of alcoholic beverages technical, analytical and nutritional aspects, vol.1 and Vol .2, ISBN:9780470512029, John Wiley & Sons, Ltd
 4. C. A. Crampton (1887) Fermented Alcoholic Beverages, Malt Liquors, Wine and Cider, Government Printing Office, Washington
 5. Catherine, Cheze, V.ercauteren J. and R. Verpoorte (2001) Polyphenols, wine and health , ISBN: 978-94-015-9644-2, Proceedings of the Phytochemical Society of Europe, Bordeaux, France
 6. Jackson R. S. (2008) Wine science-Principles and applications, 3rd edition, ISBN 978-0-12-373646-8, Elsevier Inc.

Semester – VI	
Course Code: BSC-WBAT 604T	Title of the Course: Maturation and aging of alcoholic beverages
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will learn the mechanism of maturation of alcoholic beverages.
- b. Students will learn the process of ageing.
- c. Students will be able to understand importance of cask used for different alcoholic beverages.
- d. Students will understand importance of various phytochemicals in alcoholic beverages.

Detailed Syllabus:

Unit I: **(7)**

Concept of maturation and aging of alcoholic beverages, factors affecting maturation and aging of alcoholic beverages.

Cask manufacturing:

Various cooperage oak wood use in whisky maturation, cask manufacturing–timber processing, Bourbon cask construction, control of heat treatment, cask regeneration oak, oak

Unit II: Whisky Maturation: **(7)**

Oak chemistry, whisky maturation-Wood derived aromas, reaction affecting distillate components, factor affecting whisky maturation, maturation-warehouse, maturation time fill strength.

Unit III: Wine ageing: **(8)**

Objective of wine ageing, chemical reaction occurring during wine ageing, extraction of phenolic compound from oak, factors affecting ageing of wine, bottle wine maturation.

Unit IV: Beer maturation: **(8)**

Objectives of ageing and finishing, component processes, flavor maturation-introduction, various important flavor compounds in beer, factors affecting maturation of beer.

Suggested Readings:

1. Paul S Hughes, E Denise Baxter (2001) Beer: Quality, Safety and Nutritional Aspects Royal Society of Chemistry .
2. Graham G. Stewart, Fergus G. Priest (2006) Handbook of Brewing 2nd Edition CRC Press Boca Raton.
3. Pascal Ribéreau-Gayon, Denis Dubourdieu, Bernard B. Donèche, Aline A. Lonvaud, John Towey (2021) Handbook of Enology, Volume 1: The Microbiology of Wine and Vinifications, 3rd Edition.
4. Schahinger, Geoffrey, (2005) Cooperage for winemakers : a manual on the construction, maintenance and use of oak barrels / Geoffrey Schahinger and Bryce Rankine Revised edition Ryan Publications Australia.
5. Ian S Hornsey (2003) A History of Beer and Brewing RSC publications .
6. Pascal Ribéreau-Gayon, Yves Glories, Alain Maujean, Denis Dubourdieu, John Towey (2021) Handbook of Enology, Volume 2: The Chemistry of Wine Stabilization and Treatments, 3rd Edition .

Semester – VI	
Course Code: BSC-WBAT 605T	Title of the Course: Alcoholic Beverages: Laws and Regulatory Policies
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- Students will understand laws related to wine, beer and alcohol.
- Students will be able to understand laws related to marketing.
- Students will understand Advertising Standards Council of India.
- Students will be able to understand importance of patenting.

Detailed Syllabus:

Unit I:

Introduction to alcoholic beverage industry and Regulatory Policies: (15)

Introduction and background of wine, beer and alcohol industry

Alcoholic beverage industry and legal environment

State Excise Policies and Revenue System across various states in India: Licensing, restrictions, MLDA, Ban on Advertising, Promotion and Sponsorship

Alcohol laws:

Laws for people in India and worldwide.

Laws for breweries, wineries and distilleries in India and worldwide.

Taxation related to alcohol in India and worldwide.

Introduction to Advertising Standards Council of India(ASCI):

Introduction, role and working of ASCI

Unit II: (15)

Law related to alcohol marketing on digital media

Overview on Goods and Service Tax

Patent

Introduction and importance of patenting, laws regarding patenting, types of patents and their importance

Cross border business laws for alcohol industry:

Introduction to shipping and logistics and its process, alcohol shipment procedure from India throughout the world, international business related to alcohol industry.

Laws related to illicit alcohol in India:

Meaning of illicit alcohol, different laws of different states of India, different laws and punishment for illegal alcohol making and trading in India and worldwide

Suggested Readings:

1. Adarsh Ramanujan, 2020 Patent Law Cases And Materials: A Synthesis For India , Wolters Kluwer India Pvt. Ltd.
2. Manual From Government of Maharashtra, State Excise Department Vol-I
3. Richard, Stim-2012 Patent, Copyright & Trade Mark: An Intellectual Property Desk References 16th Edition
4. Paul Wagner, Jane Enolsen, Andlitz Hach-2019 Wine Marketing & Sales 3rd Edition Board and Bench Publishing
5. Philip, Kotler- 2015 Marketing Management, 15th Edition, Pearson Education India
6. Russell Jesse-Alcohol Laws In India
7. Sheetal Chopra–2018 A Book On Indian Patenting System and Patent Agent Examination 1st Edition Nation Press

Semester – VI	
Course Code: BSC-WBAT 606T	Title of the Course: Waste Treatment II
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- Students will understand solid waste and its management.
- Students will understand various techniques of biological unit processes.
- Students will learn advanced treatment of wastewater.
- Students will study concept of BOD, COD and TOD measurement.

Detailed Syllabus:

Unit I: Waste and its management: (14)

Concept of environmental pollution, introduction to waste, health and environment concerns, sources of waste, types of waste, industrial waste vs domestic waste, composition of waste (organic, inorganic and metallic constituents)

Bioremediation: Introduction, types, factors affecting, advantages, limitations, applications.

Microbial Bioremediation, Phytoremediation, Biostimulation, Bioaugmentation, Xenobiotic components and its degradation.

Concept of 4R principle in waste treatment.

Unit II: Biological Wastewater Treatment: (16)

Measurement of BOD, COD, TOD: Introduction, five-day BOD procedure, extended BOD test, manometric BOD test, BOD assessment in minutes, factor affecting variation in BOD-seeding, pH, temperature, toxicity, incubation time, nitrification, COD-Standard dichromate COD procedure, COD detector, TOD- TOD analyzer.

Biological Unit Processes: Outline of waste water treatment, biological waste water treatment, aerobic and anaerobic, sludge treatment and disposal.

Advanced treatment of wastewater

Removal of phosphorus from wastewater.

Removal of nitrogen from wastewater.

Disposal of effluent-Sea and rivers, lagoons, spray irrigation, landfilling etc.

Wastewater treatment of beverage industry–

Outline of waste water treatment for distillery and winery.

Suggested Readings:

1. T.D. Brock (2010), Biology of Microorganisms 13th edition, Benjamin-Cummings Pub Co.
2. R.S. Ramalho (2010), Introduction of Waste water treatment, 2nd edition, Academic Press
3. C.A. Edwards and; G.U. Veeresu (1978) “Soil Biology and; Ecology in India”, Published by University of Agricultural Sciences, Hebbal, Bangalore
4. R.K. Trivedi (2007), Environmental and Industrial Pollution control. Vol. I , Akashdeep Publishing House
5. Technical EIA guidance manual for distilleries (2009), Ministry of Environment and; Forest, Govt. of India
6. Management of Distillery Wastewater (2001) Central Pollution Control Board, Ministry of Environment and Forest

Semester –VI	
Course Code: BSC-WBAT 607P	Title of the Course: Practical course –I
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will learn production of Indian whisky.
- b. Students will learn production of German wheat beer.
- c. Students will be able to determine the quality of alcoholic beverages.
- d. Students will study the technique of sensory evaluation.

Sr. No.	Title of the Practical	No. of Practicals
1.	Determination of moisture content and total solids of molasses sample.	1
2.	Determination of suspended solids, total dissolved solids and ash content of molasses.	1
3.	Determination of sludge content of given molasses sample.	1
4.	Determination of fermentation efficiency of yeast growing on molasses medium.	1
5.	Production of Indian whiskey from molasses base fermented wash.	2
6.	Determination of methyl alcohol content of rectified spirit.	1
7.	Determination of starch content of given grain flour sample.	1
8.	Production of German wheat beer.	2
9.	The organization of wine evaluation: the space, equipment, temperature, order of serving the wines.	1
10.	Sensory evaluation of wine and scoring it.	1
11.	Sensory assessment of wine and beer (pair, three-angel, duo-trio test, The differentiation test, ranking test hedonic rating test and description analysis).	1
12.	Sensory evaluation of beer.	1
13.	Sensory evaluation of whisky/rum.	1

Semester – VI	
Course Code: BSC-WBAT-608	Title of the Course: Practical Course II
Credits: 2	Total Practical Hours: 45

Course Outcomes (COs):

- a. Students will study various flavoring materials used in alcoholic beverage industry.
- b. Students will be able to understand the biochemical characteristics of flavoring materials like oak.
- c. Students will be able to understand the physicochemical characteristics of flavoring materials.

Sr. No.	Title of the Practical	No. of Practicals
1.	Physical inspection of oak wood for moisture content and quality.	1
2.	Study of oak wood biochemistry and its importance in maturation of wine/ whisky.	2
3.	The art and science of blending wine	1
4.	To determine the moisture content, sterility of cork and sterility testing of bottled wines	2
5.	Determination of total sugar as invert sugar in final molasses.	1
6.	Lab trial of molasses /starch based fermentation in distillery.	2
7.	Determination of volatile acids of fermentation raw materials.	1
8.	Determine reducing sugar of wine by rebelein method.	1
9.	Comparative analysis of fresh and aged wine/ scotch whisky.	2
10.	Estimation of alcohol content of beer by hydrometer and specific gravity method	1
11.	Visit to winery/brewery /distillery	1

Semester – IV	
Course Code: BSC-WBAT 609P	Title of the Course: Practical course –III
Credits: 2	Total Practical Hours: 45

Course Outcomes (COs):

- a. Students will learn physical, chemical and biological characterization of wastewater.
- b. Students will able to analyze hardness of water.
- c. Students will able to perform genotoxicity/cytotoxicity assay.
- d. Students will learn assessment of treated waste water for potability of water.

Sr. No.	Experiment Title	No. of Practical's
1.	Characterization of waste water-Physical-Colour, odor, conductivity, Chemical – pH, alkalinity	2
2.	Determination of TSS and TDS from the given sewage sample	1
3.	Determination of hardness of water and chloride content.	2
4.	Estimation of dissolved oxygen and determination of BOD five day (waste water /winery effluent)	1
5.	Determination of COD (waste water /winery effluent)	
6.	Testing Cytotoxicity/Genotoxicity of water sample- polluted and non-polluted	2
7.	Study of polluted and non-polluted water by microbial estimation	1
8.	Assessment of potability of water	3
	1.Presumptive test	
	2. Conformed test	
	3.Completed test	
	4. Eijkman's test	

Semester – VI	
Course Code: BSC-WBAT 610T	Title of the Course: Enzyme Technology
Credits: 2	Total Hours: 30 Hrs.

Course Outcomes (COs):

- a. Students will learn the basic concepts of enzymes.
- b. Students will study the factors affecting enzyme activity.
- c. Students will learn enzyme activity, kinetics, mechanism of action, and regulation.
- d. Students will understand the applications of enzymes in the wine, brewing, and alcohol industry.

Detailed Syllabus:

Unit I: Enzymes and enzyme catalysis: (06)

Introduction, definitions of active sites, models for enzyme catalysis- Lock and key, Induced fit hypothesis, enzyme units, specific activity, properties of enzymes, the concept of purity of enzyme.

Protein nature of enzymes and Non-protein enzymes- Ribozymes.

Mechanism of enzyme catalysis: Acid-base catalysis, covalent catalysis, metal ion catalysis

Unit II: Enzyme Kinetics: (06)

Factors affecting the enzyme activity- enzyme and substrate concentration, pH and temperature.

Kinetics of single substrate enzyme catalysed reaction.

Michaelis- Menten equation, K_m , V_{max} , Lineweaver-Burk plot.

Unit III: Enzyme Regulation: (08)

Regulation on the basis of Activity: Feedback regulation, allosteric regulation, covalent modification. Multienzyme complexes and Isoenzymes.

Mechanism of enzyme degradation: Lysosomal and non-lysosomal pathways.

Unit IV: Purification and applications of enzymes: (10)

Salt and solvent precipitation, dialysis, chromatographic techniques used for enzyme purification.

Enzyme immobilization, carrier matrices and its properties, methods of enzyme immobilization, whole enzyme/cells immobilization.

Applications of immobilized enzymes.

Applications of enzymes in the wine, brewing, and alcohol industry: cellulases, hemicellulases, invertase, amylase, lysozyme, pectinases, xylanases, glucanases, proteases, glucose oxidases, glycosidase.

Suggested Readings:

1. Eric Conn & Paul Stump, 2009, Outlines of Biochemistry, 5th Edition, John Wiley and Sons, USA
2. Donald Voet & Judith Voet, 2008, Fundamentals of Biochemistry, 3rd Edition, John Wiley and Sons, USA
3. Jeffery Zubey, 1997, Principles of Biochemistry, 4th edition, McGraw-Hill College, USA
4. Jeremy Berg, Lubert Stryer, 2012, Biochemistry, 7th Edition, W.H. Freeman and company, New York
5. David Nelson & Michael Cox, 2008, Lehninger: Principles of Biochemistry, 5th Edition, W.H. Freeman and company, New York.
6. Reginald Garrett and Charles Grisham, 2013, Biochemistry, 5th Edition, Brook/Cole, Cengage Learning, Boston, USA.
7. Palmer Trevor, 2001, Enzymes: Biochemistry, Biotechnology & Clinical chemistry, Horwood Company, England.

Semester – VI	
Course Code: BSC-WBAT- 611Pr	Title of the Course: Winter Industrial Internship/Project (Distillery/Winery) Report Writing and Presentation
Credits: 2	Total Hours: 45

Course Outcomes (Cos)

- a. Students will get exposed to a work environment, common practices, employment opportunities and work ethics in their relevant field.
- b. It will help students in organization of research ideas, material, and objectives for their dissertation.
- c. Students will get the opportunity to apply the knowledge and skills they have acquired on campus in a real-life work situation.
- d. It will help to enhance the employability skills of the students.

Detailed Syllabus:

It Involves Industrial training or Laboratory/experimental/field work under the guidance of a supervisor, leading to presentation of a comprehensive report based on the experiential learning, through focused skill building activity.

The objective of this course is to help students in organization of research ideas, material, and objectives for their dissertation and development of communication skills.

After completion of this course, the students should present a detailed project report comprising of

- i. A scientific topic and relevant design of hypothesis
- ii. Aims, objective and Significance
- iii. Review of literature
- iv. Methodology/Technology used
- v. Experimental outcome and critical analysis
- vi. Summary and conclusion
- vii. References in appropriate referencing styles.

Student will submit the Project report and will be assessed as per the following guidelines.

SEM VI	Course	External	Internal	Contents of the Report/ Oral Presentation
	BSC- WBAT- 611	35	15	i. Topic selected ii. Aims and objective and significance iii. Literature review (for report) iv. Plan of work v. Methodology/Technology used vi. Results and Discussion: (Experimental outcome and critical analyses) vii. Summary and conclusion viii. References in appropriate referencing styles.
	Oral Presentation and Viva			