

**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, BREWING AND ALCOHOL TECHNOLOGY**

Implemented from

**Academic year 2021 -22**

**F.Y. B. Sc. (Wine, Brewing and Alcohol Technology)****Semester – I**

<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
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
		<b>Total Credits</b>	<b>22</b>

**Semester – II**

<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
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
		<b>Total Credits</b>	<b>22</b>

**S.Y. B. Sc. (Wine, Brewing and Alcohol Technology)****Semester –III**

<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
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 307P	Practical's Course I	02
DSPC- 10	BSC-WBAT 308P	Practical's Course II	02
DSPC- 11	BSC-WBAT 309P	Practical's Course III	02
AECC- 01	BSC-WBAT 310T	Critical thinking and Scientific Temper	02
AECC-02	BSC-WBAT311T	English/Hindi Communication	02
GE-01(A) GE-01(B)	BSC-WBAT312(A)T BSC-WBAT312(B)T	Food Technology Laboratory management	02
GE-02(A) GE-02(B)	BSC-WBAT313(A)P BSC-WBAT313(B)P	Practical's in Food Technology Practical's in Laboratory management	02
		<b>Total Credits</b>	<b>26</b>

**Semester – IV**

<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
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 - 01	BSC-WBAT 410T	Environmental Awareness	02
AECC-02	BSC-WBAT 411T	Language Communication	02
GE-03(A) GE-03(B)	BSC-WBAT 412(A)T BSC-WBAT 412(B)T	Biophysical and Biochemical techniques Plant tissue culture	02
GE-04(A) GE-04(B)	BSC-WBAT 413(A)P BSC-WBAT 413(B)P	Exercises in Biophysical and Biochemical technique Practical's in Plant tissue culture	02
		<b>Total Credits</b>	<b>26</b>

**T.Y. B. Sc. (Wine, Brewing and Alcohol Technology)****Semester –V**

<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
DSEC- 1	BSC-WBAT 501T	Basic Chemical Engineering	02
DSEC- 2	BSC-WBAT 502T	Equipment & Utilities	02
DSEC- 3	BSC-WBAT 503T	Health Benefits of Alcoholic Beverages I	02
DSEC- 4	BSC-WBAT 504T	Microbial Spoilage and Defects in Alcoholic Beverages	02
DSEC- 5	BSC-WBAT 505T	Marketing of alcoholic beverages	02
DSEC- 6	BSC-WBAT 506T	Waste Treatment I	02
DSEC- 7 Practical	BSC-WBAT 507P	Practical Course -I	02
DSEC- 8 Practical	BSC-WBAT 508P	Practical Course -II	02
DSEC- 9 Practical	BSC-WBAT 509P	Practical Course -III	02
SEC -01 *	BSC-WBAT 510T	Term Paper writing	02
SEC - 02 Practical *	BSC-WBAT 511Pr	Project Based On Viticulture or Brewing	02
		<b>Total Credits</b>	<b>22</b>

**Semester –VI**

<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
DSEC- 10	BSC-WBAT 601T	Brewing and Alcohol Technology	02
DSEC- 11	BSC-WBAT 602T	Sensory Evaluation of Wine, Beer and Alcohol	02
DSEC- 12	BSC-WBAT 603T	Health benefits of Alcoholic Beverages-II	02
DSEC- 13	BSC-WBAT 604T	Maturation and Aging of Alcoholic Beverages	02
DSEC- 14	BSC-WBAT 605T	Alcoholic Beverages: Laws and Regulatory Policies	02
DSEC- 15	BSC-WBAT 606T	Waste Treatment II	02
DSEC- 16 Practical	BSC-WBAT 607P	Practical Course I	02
DSEC- 17 Practical	BSC-WBAT 608P	Practical Course II	02
DSEC- 18 Practical	BSC-WBAT 609P	Practical Course III	02
SEC -03*	BSC-WBAT 610	Enzyme Technology	02
SEC - 04 Project*	BSC-WBAT 611Pr	Winery or Alcohol Technology Project	02
		<b>Total Credits</b>	<b>22</b>

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Choice Based Credit System (CBCS)  
Bachelor of Science (B. Sc.)

Syllabus of  
F. Y. B. Sc. Wine, Brewing and Alcohol Technology

Implemented from  
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**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**  
**New Arts, Commerce and Science College, Ahmednagar**  
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**Board of Studies in Wine, Brewing and Alcohol Technology**

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

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## **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 Harappan 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	Computer Applications	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 307P	Practical's Course I	02
32.	S. Y. B. Sc.	III	BSC-WBAT 308P	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	Critical thinking and Scientific Temper	02
35.	S. Y. B. Sc.	III	BSC-WBAT311T	English/Hindi Communication	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	Environmental awareness	02
48.	S. Y. B. Sc.	IV	BSC-WBAT 411T	Language Communication	02
49.	S. Y. B. Sc.	IV	BSC-WBAT 412(A) BSC-WBAT 412(B)	Biophysical and Biochemical techniques Plant tissue culture	02
50.	S. Y. B. Sc.	IV	BSC-WBAT 413(A)P BSC-WBAT 413(B)P	Exercises in Biophysical and Biochemical technique Practical's in Plant tissue culture	02
51.	T. Y. B. Sc.	V	BSC-WBAT 501T	Basic Chemical Engineering	02
52.	T. Y. B. Sc	V	BSC-WBAT 502T	Equipment & Utilities	02
53.	T. Y. B. Sc	V	BSC-WBAT 503T	Health Benefits of Alcoholic Beverages I	02
54.	T. Y. B. Sc	V	BSC-WBAT 504T	Microbial Spoilage and Defects in Alcoholic Beverages	02
55.	T. Y. B. Sc	V	BSC-WBAT 505T	Marketing of alcoholic beverages	02
56.	T. Y. B. Sc	V	BSC-WBAT 506T	Waste Treatment I	02
57.	T. Y. B. Sc	V	BSC-WBAT 507P	Practical Course I	02
58.	T. Y. B. Sc	V	BSC-WBAT 508P	Practical Course II	02
59.	T. Y. B. Sc	V	BSC-WBAT 509P	Practical Course III	02
60.	T. Y. B. Sc	V	BSC-WBAT 510T	Term Paper writing	02

61.	T. Y. B. Sc	V	BSC-WBAT 511Pr	Project Based On Viticulture or Brewing	02
62.	T. Y. B. Sc	VI	BSC-WBAT 601T	Brewing and Alcohol Technology	02
63.	T. Y. B. Sc	VI	BSC-WBAT 602T	Sensory Evaluation of Wine, Beer and Alcohol	02
64.	T. Y. B. Sc	VI	BSC-WBAT 603T	Health benefits of Alcoholic Beverages II	02
65.	T. Y. B. Sc	VI	BSC-WBAT 604T	Maturation and Aging of Alcoholic Beverages	02
66.	T. Y. B. Sc	VI	BSC-WBAT 605T	Alcoholic Beverages: Laws and Regulatory Policies	02
67.	T. Y. B. Sc	VI	BSC-WBAT 606T	Waste Treatment II	02
68.	T. Y. B. Sc	VI	BSC-WBAT 607P	Practical Course I	02
69.	T. Y. B. Sc	VI	BSC-WBAT 608P	Practical Course II	02
70.	T. Y. B. Sc	VI	BSC-WBAT 609P	Practical Course III	02
71.	T. Y. B. Sc	VI	BSC-WBAT 610T	Enzyme Technology	02
72.	T. Y. B. Sc	VI	BSC-WBAT 611Pr	Winery or Alcohol Technology Project	02
	<b>Total</b>	<b>06</b>	<b>72</b>		<b>140</b>

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**Syllabus of F. Y. B. Sc. Wine, Brewing and Alcohol Technology**  
**under**  
**Faculty of Science and Technology**

<b>Semester – I</b>	<b>Paper - I</b>
<b>Course Code: BSC-WBAT 101T</b>	<b>Title of the Course: Basic Microbiology I</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (Cos)**

1. Students will learn about History and Scope of Microbiology.
2. Students will learn Classification, nomenclature & Identification of microorganisms
3. Students will learn principle and working of Bright field, Dark field and Phase contrast microscopy.
4. Students will learn Bacterial classification and isolation methods
5. Students will learn the life cycle, different modes of reproduction and industrial applications of yeast

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topics</b>	<b>No. of hours</b>
<b>Unit -1.</b>	<b>Introduction, History, Branches and Scope of Microbiology:</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Biogenesis and Abiogenesis</li> <li>• Milestones and scope of microbiology.</li> <li>• Importance, occurrence and types of microorganisms (Archaeobacteria, Eubacteria, fungi, viruses, protozoa and algae)</li> <li>• Prokaryotic and Eukaryotic cells</li> <li>• Classification of microorganisms</li> </ul>	

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|-----------------|--|-----------|
| <b>Unit -2.</b> | <ul style="list-style-type: none"><li>● <b>Ultra Structure of Bacterial cell</b></li><li>● Cell wall, cell membrane, capsule, endospore, flagella and its types, mechanism of flagellar movement.</li><li>● Cell inclusions (Gas vesicles, carboxysomes, PHB granules, metachromatic granules, glycogen bodies, starch granules, magnetosomes, sulfur granules, chlorosomes)</li></ul> | <b>10</b> |
| <b>Unit -3.</b> | <b>Microbiology of yeast</b> <ul style="list-style-type: none"><li>● Characteristics features of yeast in comparison with other microorganisms</li><li>● Taxonomy and Morphology (yeast cell structure and functions of various cellular components)</li><li>● Reproduction in yeast by budding</li><li>● Applications of yeast</li></ul>  | <b>10</b> |

**Suggested Readings:**

1. Brock Biology of Microorganisms (14th Edition) 14th Edition by Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl, Thomas Brock
2. Stanier, Y., Doudoroff, M., & Adelberg, E. A. (1958). General microbiology. *General microbiology*.
3. Prescott's Microbiology 10th Edition. By Joanne Willey and Linda Sherwood and Christopher J. Woolverton
4. Black, J. G. (2017). *Microbiology: principles and explorations*. John Wiley & Sons.
5. Talaro, K. P., & Chess, B. (2018). *Foundations in microbiology*. McGraw-Hill.
6. Foster, J. W., & Slonczewski, J. L. (2017). *Microbiology: an evolving science*. WW NORTON.



<b>Semester – I</b>	<b>Paper - II</b>
<b>Course Code: BSC-WBAT 102T</b>	<b>Title of the Course: Industrial Microbiology I</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Students will learn concept of industrial Microbiology.
2. Student will be able to recall & correlate contamination, disinfection & sterilization
3. Students will understand significance of basic concepts in Microbiology (Role of nutrients in microbial growth, Crude sources of N & C, Antifoam agents, etc.)
4. Student can be able to infer basic concept of fermentation and types of fermentation etc.
5. Students will be able to apply the basic knowledge of Microbiology in wineries and breweries.

### Detailed Syllabus:

<b>Unit No</b>	<b>Topics</b>	<b>No. of Hours</b>
<b>Unit -1. Industrial Microbiology</b>		<b>04</b>
	<ul style="list-style-type: none"> <li>• Definition &amp; Scope of Industrial Microbiology.</li> <li>• Historical development in fermentation industry.</li> <li>• Multidisciplinary nature of microbiology in industry.</li> </ul>	
<b>Unit -2. Sterilization technique</b>		<b>12</b>
	<ul style="list-style-type: none"> <li>• Concept of asepsis, disinfection &amp; sterilization</li> <li>• Surface sterilization</li> <li>• Sterilization by heat – use of dry &amp; moist heat. Pasteurization methods and its types.</li> <li>• Sterilization by radiation, U.V. light &amp; <math>\gamma</math> radiation. 2.4 Filtration: Bacteriological filters, types &amp; uses</li> <li>• Disinfectant types, action &amp; applications,</li> <li>• Fumigation culture room fumigation using formalin</li> </ul>	
<b>Unit- 3. Pure culture techniques</b>		<b>10</b>
	<ul style="list-style-type: none"> <li>• Design &amp; preparation of media – Nutritional requirements ingredients</li> </ul>	

of media.

- Types of media.
- Culture media preparation- Nutrient broth, nutrient agar slant, potato dextrose agar, YEPD agar
- Preservation of pure culture, slant culture preservation, Lyophilization.

**Unit-4**

- Definition and use of the term ‘fermentation’
- A Typical Bioprocess: introduction, advantages and limitations and applications

**04**

**Suggested Readings:**

1. Stanbury, P. F., Whitaker A. & Hall S. T. (2008) Principles of Fermentation Technology
2. Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint
3. Patel A. H. (2005) Industrial Microbiology.
4. Lansing M. Prescott John P. Harley & Donald A. Klein (2005) Microbiology
5. Rojer A. Stanier (1989) General Microbiology
6. Pawar C. B. & H. F. Daginawala (1982) General Microbiology Vol.-2

<b>Semester – I</b>	<b>Paper - III</b>
<b>Course Code: BSC-WBAT 103T</b>	<b>Title of the Course: Basic Botany</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Students will learn concept of Botany.
2. Student will be able to recall & correlate Multidisciplinary nature of Botany
3. Students will understand significance of basic concepts in botany (Plant Cell structure, Mitosis, Meiosis, etc.)
4. Student can be able to infer basic concept of Genetics, Embryology, Taxonomy etc.
5. Students will be able to apply the basic knowledge of Botany.

### Detailed Syllabus:

<b>Unit No.</b>	<b>Topics</b>	<b>No. of hours</b>
<b>Unit-1. Introduction to plant kingdom</b>		<b>10</b>
	<ul style="list-style-type: none"> <li>• Botany - Definition and Multidisciplinary nature of Botany</li> <li>• Plant as a life form- General &amp; Unique features of plants as a category of living organisms</li> <li>• A general account of different groups (Algae, Fungi) traditionally studied in botany, their economic importance with example</li> <li>• Introduction to plant groups and their characters with respect to increasing complexity in organization of plant body (Bryophytes, Pteridophytes, Gymnosperms, Angiosperms: Dicot &amp; Monocot plants)</li> </ul>	
<b>Unit-2. Vegetative &amp; Reproductive Morphology of plants</b>		<b>08</b>
	<ul style="list-style-type: none"> <li>• Structure of typical plant and different parts of plant (Root, Stem &amp; Leaf)</li> <li>• Shift from vegetative to reproductive phase</li> <li>• Inflorescence: Definition, Types of inflorescence and Significance</li> <li>• Morphology of reproductive plant organs Flower: Definition and symmetry, Parts of flower: Pedicel, Thalamus, Floral whorls: calyx,</li> </ul>	

corolla, androecium and gynoecium

- Fruit & its types

### Unit-3. Plant Cell Biology & Genetics

12

- Unique features of a plant cell
- Cell cycle, cell division, mitosis and meiosis stages and their significance
- Programmed Cell Death- ageing, senescence and necrosis
- Overview of Mendel's laws of Inheritance with reference to monohybrid and dihybrid ratio, Codominance & Incomplete dominance Linkage & Crossing Over

#### Suggested Readings:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4<sup>th</sup> edition.
2. An introduction to embryophyta, 5th edition (1972), Parihar N.S. (Central Book Depot, New Delhi)
3. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
4. Cummings, U.S.A. 10 edition.
5. Dutta A.C. (2000) A Classbook of Botany (Oxford University Press, UK)
6. Ganguli, Das Dutta (2011) – College Botany Vol I, II and III (New Central Book Agency, Kolkata)
7. Kumar H.D. (1999) Biodiversity and sustainable conservation (Oxford & IBH, New Delhi)

<b>Semester – I</b>	<b>Paper - IV</b>
<b>Course Code: BSC-WBAT 104T</b>	<b>Title of the Course: Plant Development and Anatomy</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Students will learn scope and objectives of Anatomy
2. Student will be able to infer basic concept of tissue system.
3. Students will understand different plant propagation techniques
4. Student will be able to recall & correlate significance of Economic Botany
5. Students will be able apply the basic knowledge for taxonomy, phylogenetic studies, wood identification, pharmacognosy, etc.

### Detailed Syllabus:

Unit	Topic	No. of hours
<b>Unit-1. Plant Anatomy</b>		<b>14</b>
	<ul style="list-style-type: none"> <li>• Definition, concept, scope and objectives.</li> <li>• Outline with brief description, simple and complex tissues.</li> <li>• Meristematic tissue system: Meristem, characters and types based on origin, position and plane of division, functions</li> <li>• Simple tissues: parenchyma, collenchyma, sclerenchyma</li> <li>• Complex/Vascular tissues: Components of xylem and phloem, types of vascular bundles and functions</li> <li>• Concept of Mechanical Tissue system</li> <li>• Epidermal tissues: Epidermis, structure of typical stomata, trichomes, Rhizodermis, motor cells; functions.</li> <li>• Anatomy of Monocot &amp; Dicot (root, stem &amp; leaf)</li> </ul>	
<b>Unit-2. Plant Development</b>		<b>16</b>
	<ul style="list-style-type: none"> <li>• Unique features of plant and plant development</li> <li>• Plant development at: Cellular, organ and whole-plant levels</li> <li>• Vegetative development of plant: Seed germination, Vegetative maturity &amp; factors</li> </ul>	

affecting it.

- Reproductive development of plant: Shift from vegetative to reproductive phase, Induction- perception of inductive stimuli and subsequent changes
- Microsporangium: structure of tetrasporangiate anther, tapetum types, sporogenous tissue, microsporogenesis, significance of callose deposition and microgametogenesis
- Megasporangium: structure and types of ovules, megasprogenesis, development of female gametophyte (monosporic, bisporic and tetrasporic)
- Double fertilization and triple fusion, Development of endosperm and Embryogenesis in dicot and monocot plants
- Apomixis and polyembryony Definition, types and Practical applications
- Plant growth regulators and their role in growth and development (*in vivo*)

#### **Suggested Readings:**

1. Bhojwani, S.S., & Bhatnagar, S.P. An embryology of Angiosperm
2. Chandurkar, P.J. (1983). Plant Anatomy. Oxford & IBH Publishing Co, Calcutta
3. Cutler, Botha & Stevenson (2007) Plant anatomy: an applied approach (Blackwell Sci, USA)
4. Eames, A.J. & Macdaniels, L.H. (1947) An Introduction to Plant Anatomy. McGraw-Hill, N.Y. and London
5. Esau K. (1977) Anatomy of seed plants (Wiley, USA)
6. Esau, K. (1977). Anatomy of seed plants, John Wiley & Sons, Inc. London
7. Fahn, A. (1997). Plant Anatomy. Pergamon Press, Oxford

<b>Semester – I</b>	<b>Paper - V</b>
<b>Course Code: BSC-WBAT 105T</b>	<b>Title of the Course: Basic Biochemistry I</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Students will learn scope and objectives of biochemistry in wine science
2. Student will be able to infer basic concept of biomolecules.
3. Students will understand different analytical techniques
4. Student will be able to recall & correlate biochemical techniques in wine industry
5. Students will be able apply the basic knowledge for wine analysis and yeast strain.

### Detailed Syllabus:

<b>Unit No.</b>	<b>Topics</b>	<b>No. of Hours</b>
<b>Unit-1</b>	<b>Introduction to Biochemistry.</b>	<b>4</b>
	<ul style="list-style-type: none"> <li>• Concept &amp; scope of Biochemistry.</li> <li>• Application of biochemistry in wine science.</li> <li>• Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms.</li> <li>• Types of bond, Covalent and non-covalent interactions in biomolecules with suitable examples.</li> </ul>	
<b>Unit-2</b>	<b>Water:</b>	<b>4</b>
	<ul style="list-style-type: none"> <li>• Unique property of water as a universal solvent and its importance in biological system</li> <li>• Understanding of concepts of acids, bases, pH, indicators, pKa values, buffers etc.</li> </ul>	
<b>Unit-3</b>	<b>Carbohydrates:</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Definition, empirical formulae, Classification of carbohydrates– Monosaccharides, Oligosaccharides and Polysaccharide.</li> <li>• Monosaccharides: Structure &amp; properties of Monosaccharides, ketoses and aldoses, D and L configuration, epimers, anomers,</li> </ul>	

chemical and physical properties; glycosidic bonds, reducing and non-reducing sugars.

- Oligosaccharides: Sucrose, Lactose and Maltose as examples.
- Polysaccharides and its classification  
Storage polysaccharide: example starch, glycogen  
Structural polysaccharides: example cellulose, chitin
- Biological Importance of Carbohydrates

#### **Unit-4 Lipids:**

**10**

- Fatty acids- Classification and nomenclature
- Structure, chemical and physical properties
- Classification of lipids: Simple, complex and derived lipids
- Simple lipids- Oil, Fat and wax
- Complex lipids: Phospholipids and Glycolipids
- Derived lipids: Steroids, terpenoids and carotenoids
- Biological Importance of lipids.

#### **Suggested Readings:**

- Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Fundamentals of Biochemistry. 3rd Edition, (2008), Donald Voet & Judith Voet, John Wiley and Sons, Inc. USA
3. Principles of Biochemistry, 4th edition (1997), Jeffery Zubey, McGraw-Hill College, USA
4. Biochemistry: 7th Edition, (2012), Jeremy Berg, Lubert Stryer, W.H. Freeman and company, NY
5. Lehninger , Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.
6. Biochemistry. 5th Edition, (copyright 2013), Reginald Garrett and Charles Grisham, Brook/ Cole, Cengage Learning, Boston, USA.



<b>Semester – I</b>	<b>Paper - VI</b>
<b>Course Code: BSC-WBAT 106T</b>	<b>Title of the Course: Computer Applications</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Study the history of evolution and generations of computers.
2. Classify the computers.
3. Introduction to computers Overview and functions of a computer system.
4. Modern computers, Introduction to operating systems, Data processing and Computer viruses.
5. Computer Networking, Internet searches Algorithms, Flowcharts and Programming concepts Databases.

### Detailed Syllabus:

Unit No.	Topics	No.of Hours
<b>Unit-1</b>	<p><b>History:</b></p> <ul style="list-style-type: none"> <li>• Generations of computers (I, II, III, IV, V)</li> <li>• Modern computers: The workstation, The Minicomputer,</li> <li>• Mainframe Computers, Parallel processing Computer &amp;</li> <li>• The Super Computer.</li> </ul> <p><b>Introduction to computers:</b></p> <ul style="list-style-type: none"> <li>• Overview and functions of a computer system</li> <li>• Input and output devices</li> <li>• Storage devices: Hard disk, Diskette, Magnetic tape, RAID,</li> <li>• ZIP devices, Digital tape, CD-ROM, DVD, Flash drive, SSD (capacity and access time)</li> </ul> <p><b>Introduction to operating system:</b></p> <ul style="list-style-type: none"> <li>• Operating system concept-Windows, Unix/Linux and Mac OS</li> </ul>	<b>10</b>
<b>Unit-2.</b>	<p><b>Data processing &amp; presentation:</b></p> <ul style="list-style-type: none"> <li>• Introduction : MS office (Word, Excel &amp; Power Point)</li> </ul> <p><b>Computer viruses:</b></p>	<b>08</b>

- An overview of Computer viruses
- What is a virus? Virus symptoms, How do they get transmitted?
- General Precautions

**Internet searches:**

- Concepts in text-based searching, Searching Medline.
- PubMed, bibliographic database

**Unit-3. Computer Networking: 08**

- Introduction to networking: various terminologies
- Associated hardware devices, gadgets (Router, Switch) tools, services, and resources
- Network Topologies and Protocols, LAN, WAN and MAN World
- World Wide Web (WWW) Network security: fire walls

**Unit-4. Introduction & need of databases, Types of databases, 04**

- Introduction & Overview of Biological database, Types of
- Biological Database
- Bioinformatics: Introduction to bioinformatics, History, Goals,
- Relation to other fields.

**Suggested Readings:**

1. Computer Fundamentals , 4th edition (2004) P.K. Sinha, BPB publication, India
2. Computer Networks. 4th edition (2008). Tanenbaum. Pearson Education, India
3. Introduction To Database Management Systems, 1st edition, (2004), Atul Kahate, Pearson education, India
4. Bioinformatics – Principles and Applications by Zhumur Ghosh, Bibekan and Mallick-Oxford university press
5. Introduction to Bioinformatics by Teresa Attwood and David. J.Parry Smith Pearson education
6. Computer Fundamentals, 4th edition (2004) P.K. Sinha, BPB publication, India
7. Computer Networks. 4th edition (2008). Tanenbaum. Pearson Education, India
8. Introduction To Database Management Systems, 1st edition, (2004), Atul Kahate, Pearson education, India.

<b>Semester – I</b>	<b>Paper - VII</b>
<b>Course Code: BSC-WBAT 107T</b>	<b>Title of the Course: Basic Oenology</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (COs)

1. Learn the concept of viticulture, Wine-producing regions of the world and different practices of wine making.
2. Understand the grapevine and concept of Terrior
3. Classify the wines types.
4. Compare and contrast Vine and Wine.
5. Learn the procedure of barrel making.

### Detailed Syllabus:

Unit No.	Topics	No of Hours
<b>Unit-1</b>	<b>Wine making:</b> <ul style="list-style-type: none"> <li>• Introduction to winemaking, important terminologies of wine: Racking, Tears, Chaptalization, Thermowine/Thermovinification, Rémuage, Thief etc.</li> <li>• Viticulture: Introduction to viticulture, important terminologies.</li> <li>• Wine history (“old” and “new” world wine).</li> <li>• Terroir: Concept of Terroir and importance of Terroir.</li> </ul>	<b>08</b>
<b>Unit-2</b>	<b>Classification of wines:</b> <ul style="list-style-type: none"> <li>• Generic classification, varietal classification, Vinification classification, classification on the basis of chemical constituents and introduction to taste classification.</li> <li>• Flow chart of white wine-production and recommended varieties.</li> <li>• Flow chart of Red wine-production and recommended varieties.</li> <li>• Flow chart of Sparkling wine-production and recommended varieties.</li> <li>• Production of wine from fruits other than grapes (e.g. Apple).</li> </ul>	<b>11</b>

**Unit-3 Grapevines: 11**

- Classification, function of various parts of grapevine.
- Common wine grape varieties –red and white grape varieties, Anatomy of grape berry
- Chemical Constituents of Wines.
- Introduction to barrel: Distribution, species and advantages of oak.

**Suggested Readings:**

1. Ron s. Jockson (2000) Wine science principles practices & perception
2. Vine, Richard p (1997) WineAppreciation
3. Emile Peynavd (1997) The taste ofwine
4. Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine analysis and production.
5. C. S. Ough (1992) Wine making Basics.

<b>Semester – I</b>	<b>Paper - VIII</b>
<b>Course Code: BSC-WBAT 108T</b>	<b>Title of the Course: Sensory Evaluation of wine I</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (COs)**

1. Learn the sensory evaluation of wine
2. Understand the concept of commercial aspects of wine production.
3. Acquire the knowledge of Wine appellations and regulations
4. Learn the methods of Wine marketing.
5. Understand the new concept in wine production which includes Organic wines and Biodynamic wines.

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topics</b>	<b>No. of Hours</b>
<b>Unit-1</b>	<b>Sensory evaluation and terminologies</b>	<b>08</b>
	<ul style="list-style-type: none"> <li>• The basic tastes of wine: bitterness, acidity, salt, sweetness, and alcohol on the tongue.</li> <li>• Sensory perception -study of tongue anatomy with reference to sensory response, study of olfactory organ with reference to sense of smell.</li> <li>• Factors influencing taste perception.</li> </ul>	
<b>Unit-2</b>	<b>The art of tasting wine – Appearance, aroma and taste of wine.</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Sensory evaluation and scorecard: Rose worthy scorecard, Davis scorecard and Sparkling wine score-card.</li> <li>• Classification of Aroma : Primary, Secondary and Tertiary aroma</li> <li>• Introduction to aroma wheel.</li> </ul>	
<b>Unit-3</b>	<b>Design of tasting room, timing of tasting wine.</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Taste the wine on the basis of three important senses i.e. vision, smell and palate structure.</li> <li>• Selection &amp; different types of glass, serving temperature of wine.</li> <li>• Classification of Wine Bottles on the basis of color, shape and size</li> <li>• Storage of wine in cellar and supermarkets.</li> </ul>	

**Suggested Readings:**

1. Ronald S. Jackson (2002) Wine Testing a professional handbook
2. Roger B. Boulton (1996) Principles and practices of wine making
3. Emile Peynalld (1984) Knowing & making wine
4. Patrice Iland & Peter Gago (1997) Australian wine from the grasp vine to the glass

<b>Semester – I</b>	<b>Paper - IX</b>
<b>Course Code: BSC-WBAT 109P</b>	<b>Title of the Course: Practicals in Microbiology</b>
<b>Credits: 1.5</b>	<b>Total Hours: 45</b>

### Course Outcomes (Cos)

1. Study Glassware's used in Microbiology laboratory and its cleaning.
2. Study of different equipments used in winemaking and processing.
3. To study preparation of liquid medium -nutrients broth, sugar fermentation media.
4. To learn preparation of nutrient agar, agar slant, agar butt and glucose yeast extract medium.
5. Isolation of microorganism by streak plate method, pour plate, spread plate method and Staining.
6. To study Isolation of bacteria and yeast and Staining.

### Detailed Syllabus:

<b>Sr. No</b>	<b>Experiment Title</b>	<b>No. of Practicals</b>
1.	Safety Measures and Good Laboratory Practices in Microbiology laboratory	01
2.	Introduction and use of common microbiology laboratory instruments and glass wares	01
3.	Learning basic techniques in Microbiology: Wrapping of glassware, Cotton plugging, cleaning and washing of glassware.	01
4.	Aseptic Transfer Techniques	01
5.	Study of Microscope- Compound Microscope & its parts. Use of oil immersion objective.	01
6.	Hanging drop preparation for observation of motility	01
7.	Preparation of nutrient medium -nutrients broth, Sabouraud broth and PDB	01
8.	Preparation of nutrient agar medium, agar slant and PDA	01
9.	Effect of pH and temperature on Microbial Growth.	02
10.	Effect of salts on microbial growth.	01
11.	Working of laboratory fermenter	01

### Suggested Readings:

1. P. Gunasekaran (2005) Laboratory Manual in Microbiology

2. Stanbury, P. F., Whitaker A. & Hall S. T. (2008) Principles of Fermentation Technology
3. Anuradha De. (2009) Practical and applied microbiology
4. John Grainger (2001) ,Basic practical microbiology Panda U. N. (2005) Handbook of Microbiology and parasitology
5. Anuradha De. (2009) Practical and applied microbiology
6. Prescott Hurley Kline's (2008) Microbiology
7. Sathe S. T., Pharande S. R. (2010) Introduction to Microbiology



<b>Semester – I</b>	<b>Paper - X</b>
<b>Course Code: BSC-WBAT 110P</b>	<b>Title of the Course: Practicals in Botany</b>
<b>Credits: 1.5</b>	<b>Total Hours: 45</b>

**Course Outcomes (COs)**

1. Students will practically learn anatomical details of plant (different tissues systems)
2. Students will practically understand how to prepare nursery beds and rising of seedling per plant
3. Students will be able to infer basic concept of paper Chromatography practically.
4. Students will be able apply the basic knowledge of botany for plant propagation.
5. Student will be able to recall & correlate significance of theoretical knowledge.

**Detailed Syllabus:**

<b>Sr. No.</b>	<b>Experiment Title</b>	<b>No. of Practicals</b>
1.	Study of typical plant and plant parts	01
2.	Observation of different types of inflorescence in plants.	01
3.	Observation of parts of flower	01
4.	Study of different types of fruits	01
5.	Study of plant cell types using squash techniques	01
6.	Study of plant cell types using Maceration techniques	01
7.	Study of meristematic tissue system and Programmed Cell Death in plants	01
8.	Study of permanent tissue system (simple and complex)	01
9.	Study of epidermal tissue system (trichomes and stomata)	01
10.	Observation of internal structure of typical monocot root, stem and leaf	01
11.	Observation of typical dicot root and stem and leaf	01
12.	Study of embryological evidences in plants & Observation of embryo in monocot and dicot seeds	01

**Suggested Readings:**

1. Bhojwani, S.S., & Bhatnagar, S.P. An embryology of Angiosperm
2. Maheshwari, P. An Introduction to embryology of Angiosperm
3. Pandey, S.N. & Ajanta Chadha. Plant Anatomy and Embryology. Vikas Publishing House Pvt.

Ltd., New Delhi

4. Chandurkar, P.J. (1983). Plant Anatomy. Oxford & IBH Publishing Co, Calcutta

5. Khan, M.R., Ahire, S.V., Gadekar, S.S., Parale, A.P. and Auti, S.G. (2014) Plant Anatomy and Embryology and Plant Biotechnology, Success Publication.

6. Eames, A.J. & Macdaniels, L.H. (1947) An Intriduction to Plant Anatomy. McGraw-Hill, N.Y. and London.

<b>Semester – I</b>	<b>Paper - XI</b>
<b>Course Code:</b> BSC-WBAT 111P	<b>Title of the Course:</b> Practicals in Biochemistry and Computer application
<b>Credits:</b> 1.5	<b>Total Hours:</b> 45

**Course Outcomes (Cos)**

1. Students will practically learn to check pH, conductivity and acidity of wine
2. Students will practically understand how to prepare good quality of wine
3. Students will be able to infer basic concept of titration, centrifugation, colorimeter, and spectrophotometer, paper Chromatography practically.
4. Students will be able apply the basic knowledge of biochemistry for quality control of industrial winemaking.

**Detailed Syllabus:**

<b>Sr. No.</b>	<b>Title of Experiment</b>	<b>No of Practical</b>
<b>Biochemistry</b>		
1.	Safety Measures and practices in chemistry laboratory	1
2.	Preparation of molar, normal, percent, ppm and ppb solutions.	1
3.	Measurement of pH of various solutions using pH indicator (strip) and pH meter.	1
4.	To study Acid base titration	1
5.	Qualitative tests for Carbohydrates and Lipids	1
6.	Determination of chlorine content in water	1
7.	Determination of alkalinity of water	1
<b>Computer</b>		
8	Tutorials operating systems: DOS and Windows File handling: copy, rename, delete, type Directory structure: make, rename, move directory	1

9	Word Processing (Microsoft Word): Creating, Saving & Operating a document, Editing, Inserting, Deleting, Formatting, Moving & Copying Text, Find & Replace, Spell Checker & Grammar Check, Document Enhancement (Borders, Shading, Header, Footer), Printing Document (Page Layout, Margins),	1
10	Introduction to the use of Wizards & Templates, Working with Graphics (Word Art), Working with Tables & Charts, Inserting Pictures	1
11	Spreadsheet Applications (Microsoft Excel): Worksheet Basics: Entering information in a Worksheet, Saving & Opening a Worksheet, Editing, Copying & Moving Data, Inserting, Deleting & Moving Columns & Rows, Clearing. Use of formula for Addition, mean, percentage	1
12	Usage of multimedia – Creation of Computer Presentations with graphics using Microsoft Power Point, Creation of slides, Rapid Presentation design using wizards	1

**Suggested Readings:**

1. An Introduction to Practical Biochemistry.3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu. Pvt. Ltd. New Delhi, India
2. Biochemical Methods.1st, (1995), S. Sadashivam, A. Manickam, New Age International Publishers, India
3. An introduction to practical biochemistry,David plummer
4. Introductory practical biochemistry, S.K. Sawhoey, Randhir singh

<b>Semester – I</b>	<b>Paper - XII</b>
<b>Course Code: BSC-WBAT 112P</b>	<b>Title of the Course: Practicals in Oenology</b>
<b>Credits: 1.5</b>	<b>Total Lectures: 45</b>

### Course Outcomes (Cos)

1. Students will learn the sensory evaluation of wine
2. Students will understand the concept of commercial aspects of wine production.
3. Students will acquire the knowledge of Wine appellations and regulations
4. Students will learn the methods of Wine marketing.
5. Students will understand the new concept in wine production which includes Organic wines and Biodynamic wines.

### Detailed Syllabus:

<b>Sr. No.</b>	<b>Title of Experiment</b>	<b>No. of Practicals</b>
1	Introduction to Wine, brewing and alcohol technology laboratory and study of common Wine, brewing and alcohol technology laboratory instruments e.g. Refractometer, Hydrometer, Colorimeter, pH Meter, Distillation Unit, Balance etc.	1
2	Study of grapevine varieties.	1
3	Study of grape berry	1
4	Determination of Brix and pH of grapes/fruits juice and wine	1
5	To study threshold detection of acid taste.	1
6	To study threshold detection of sweet taste.	1
7	To study threshold detection of bitter taste.	1
8	To study threshold detection of salt taste.	1
9	Detection of different aromas in wine using aroma wheel.	1
10	Types of wine glasses and bottles	1
11	Study of a 50 KL winery and report writing	2

**Suggested Readings:**

1. Ronald S. Jackson (2002) Wine Testing a professional handbook
2. Ron s. Jockson (2000) Wine science principles practices & perception
3. Vine, Richard p (1997) Wine Appreciation
4. Emile Peynavd (1997) The taste of wine
5. Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and Production

<b>Semester – II</b>	<b>Paper - I</b>
<b>Course Code: BSC-WBAT 201T</b>	<b>Title of the Course: Basic Microbiology II</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Students will learn the Microscopy Techniques.
2. Students will understand the concept of Microbial Growth, Reproduction and Measurement.
3. Students will acquire the knowledge of Staining Techniques.
4. Students will learn the methods of measurement of bacterial growth.

### Detailed Syllabus:

Unit No.	Topics	No. of hours
<b>Unit-1. Microscopy</b>		<b>10</b>
	<ul style="list-style-type: none"> <li>• Introduction to Microscopy</li> <li>• Types of Microscopy- Light and Electron</li> <li>• Different concepts in Microscopy: resolving power, resolution, contrast, numerical aperture, working distance and magnification</li> <li>• Principles and applications of a) Bright field microscopy &amp; b) Dark field microscopy c) Phase contrast microscopy</li> <li>• Introduction to Electron Microscopy – TEM, SEM</li> </ul>	
<b>Unit-2. Microbial Growth, Reproduction and Measurement</b>		<b>12</b>
	<ul style="list-style-type: none"> <li>• Growth curve, introduction to kinetics of growth, generation time, growth rate.</li> <li>• Reproduction in microorganisms: sexual reproduction and asexual reproduction.</li> <li>• Measurement of Bacterial growth- Methods of enumeration: Microscopic methods (Direct count), Cell counter, Plate counts (Total viable count), Turbidometric methods.</li> </ul>	
<b>Unit-3. Staining Techniques:</b>		<b>08</b>

- Definitions of Stain; Types of stains (Basic and Acidic).
- Concept, Properties and role of Fixatives, Mordant, Decolourisers and Accentuators.
- Types of staining: Monochrome staining, Negative (Relief) staining and Differential staining - Gram staining and Special staining (Flagella, endospore)

**Suggested Readings:**

1. Microbiology. by Michael J. Pelczar Jr., Roger D. Reid, et al.
2. Microbiology: An Introduction, Global Edition. Edited by Gerard J. Tortora
3. Brock Biology of Microorganisms (14th Edition) 14th Edition by Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl, Thomas Brock
4. Stanier, Y., Doudoroff, M., & Adelberg, E. A. (1958). General microbiology. *General microbiology*.
5. Prescott's Microbiology 10th Edition. By Joanne Willey and Linda Sherwood and Christopher J. Woolverton
6. Black, J. G. (2017). *Microbiology: principles and explorations*. John Wiley & Sons.
7. Talaro, K. P., & Chess, B. (2018). *Foundations in microbiology*. McGraw-Hill.
8. Foster, J. W., & Slonczewski, J. L. (2017). *Microbiology: an evolving science*.



<b>Semester – II</b>	<b>Paper - II</b>
<b>Course Code: BSC-WBAT 202T</b>	<b>Title of the Course: Industrial Microbiology II</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

### Course Outcomes (Cos)

1. Students will understand the concept of fermentation.
2. Students will learn the preparation of fermentation media.
3. Students will gain the knowledge of Upstream & Downstream processing.
4. Students will learn the culture collection centers.

### Detailed Syllabus:

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hours</b>
<b>Unit-1</b>	<b>Introduction to Fermentation</b>	<b>06</b>
	<ul style="list-style-type: none"> <li>• Fermenter; Parts of Fermenter</li> <li>• Types of fermenters</li> <li>• Types of fermentation</li> <li>• 1.4 Types of fermentation products</li> </ul>	
<b>Unit-2</b>	<b>Fermentation Media</b>	<b>08</b>
	<ul style="list-style-type: none"> <li>• Components of typical fermentation medium.</li> <li>• Role of nutrients in microbial growth.</li> <li>• Crude sources of Nitrogen &amp; Carbon.</li> <li>• Antifoam agents.</li> <li>• Sterilization of media and Industrial fermenters</li> </ul>	
<b>Unit-3.</b>	<b>Production strain</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Screening of Production strain: Primary and secondary</li> <li>• Inoculum preparation – outline</li> <li>• Strain Improvement and its techniques</li> <li>• Stock cultures and its maintenance</li> <li>• Culture collection centers and their objectives</li> </ul>	
<b>Unit-4</b>	<b>Downstream processing</b>	<b>6</b>
	<ul style="list-style-type: none"> <li>• Overview of downstream processing</li> </ul>	

- Separation Techniques: Centrifugation, Filtration
- Purification methods – Liquid-liquid extraction, Distillation,
- Ultrafiltration, Chromatography

**Suggested Readings:**

1. Stanbury, P. F., Whitaker A. & Hall S. T. (2008) Principles of Fermentation Technology
2. Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint
3. Patel A. H. (2005) Industrial Microbiology.
4. Lansing M. Prescott John P. Harley & Donald A. Klein (2005) Microbiology
5. Rojer A. Stanier (1989) General Microbiology
6. Pawar C. B. & H. F. Daginawala (1982) General Microbiology Vol.-2

<b>Semester – II</b>	<b>Paper - III</b>
<b>Course Code: BSC-WBAT 203T</b>	<b>Title of the Course: Plant Physiology</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (Cos)**

1. Students will understand the concepts of plant physiology such as Osmotic pressure (OP), turgor pressure (TP) and wall pressure (WP), etc.
2. Students will learn the Stress Physiology.
3. Students will study the physiology of flowering and seed germination.
4. Students will learn the factors involved in fruit ripening.

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topics</b>	<b>No. of Hours</b>
<b>Unit-1</b>	<b>Plant Physiology: Plant water relations &amp; Primary Metabolism</b>	<b>16</b>
	<ul style="list-style-type: none"> <li>• Permeability, Diffusion, Osmosis – Definition, significance, types, mechanism, laws and factors affecting</li> <li>• Osmotic pressure (OP), turgor pressure (TP) and wall pressure (WP), relation between OP, DPD (Suction pressure) and TP</li> <li>• Absorption of water: Ascent of sap –Cohesion-tension theory</li> <li>• Phloem loading and unloading</li> <li>• Photosynthesis: Definition and concept, Structure of Chloroplast, Photochemical and biosynthetic phases, Factors affecting photosynthesis, Photorespiration, Photosynthesis in C4 Plants and CAM Plants</li> <li>• Overview of Respiration, Oxidative Vs Photo-phosphorylation</li> <li>• Essential nutrients for growth and development of plants and their role</li> </ul>	
<b>Unit-2</b>	<b>Stress Physiology, Physiology of Flowering, Seed Germination, and Fruit ripening</b>	<b>14</b>
	<ul style="list-style-type: none"> <li>• Plant &amp; its interaction with surrounding (Biotic &amp; Abiotic components), Response of plants to biotic stresses (Host–pathogen interaction) and abiotic</li> </ul>	

stresses (light, temperature, draught and salinity)

- General classification & role of secondary metabolites
- Photo-biology: movement and photo-morphogenesis (vegetative)
- Introduction to physiology of flowering: a) photoperiodism and b) vernalization
- Seed germination and metabolic changes during seed germination
- Fruit ripening

### **Suggested Readings:**

1. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi. Co. Ltd.
2. Biochemistry and Molecular Biology of Plants, 2nd Edition Bob B. Buchanan (Editor), Wilhelm Gruissem (Editor), Russell L. Jones (Editor) ISBN: 978-0-470-71421-8 July 2015
3. Devlin R.M. (1983) - Fundamentals of Plant Physiology (Mac. Millan, New
4. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4<sup>th</sup> Edition.
5. Lehninger A. L. (1987), Principles of Biochemistry, CBS Publishers and Distributors (Indian Reprint).
6. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York, USA.
7. Nobel P. S. (1998), Physiochemical and Environmental Plant Physiology (Second Edition), Academic Press, San Diego, USA.

<b>Semester – II</b>	<b>Paper - IV</b>
<b>Course Code: BSC-WBAT 204T</b>	<b>Title of the Course: Applied Botany</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (Cos)**

1. Students will learn different plant propagation techniques.
2. Students will understand the concepts of in vitro plant regeneration.
3. Students will study the various plants used in beverage industry.
4. Students will learn the procedure of micropropagation, cutting, layering (air and ground), grafting and budding.

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topic</b>	<b>No. of Hours</b>
<b>Unit-1. Plant propagation Techniques</b>	<ul style="list-style-type: none"> <li>• Propagation:-Definition, scope and objectives,</li> <li>• Types of Plant propagation; Sexual propagation and asexual plant propagation &amp; its advantages and disadvantages</li> <li>• Sexual Propagation: Seed development and viability, seed dormancy, growing seedlings in indoor containers and field nurseries, seedling transplanting; advantages and disadvantages of seed propagation.</li> <li>• Vegetative propagation- organs used in propagation- Natural- bulbs, corms, tubers, rhizomes (storage organs), stolons and runners.</li> <li>• 1.5 Artificial propagation methods- Cutting, layering (air and ground), grafting and budding; advantages and disadvantages of artificial propagation.</li> </ul>	<b>12</b>
<b>Unit-2. In vitro plant regeneration</b>	<ul style="list-style-type: none"> <li>• Concepts of Cell theory &amp; Cellular totipotency, Historical perspective, Landmarks in plant tissue culture</li> <li>• Infrastructure &amp; Organization of plant tissue culture laboratory – General &amp; aseptic laboratory, different work areas, equipments &amp; instruments required.</li> </ul>	<b>14</b>

- Composition of media; Nutrient and hormone requirements of explants
- Steps involved in PTC & Aseptic manipulation during PTC Work
- Explant for plant tissue culture
- Response of explants *in vitro*– Dedifferentiation and redifferentiation
- Concept of callus formation, organogenesis (direct and indirect) and embryogenesis (direct and indirect)
- Micropropagation

**Unit-3. Plants used in beverage industry****4**

- Cereals e.g. Wheat, Barley
- Fruit crops e.g. Grape,
- Aromatic/flavoring plants e.g. Hops, Cinnamon

**Suggested Readings:**

1. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
2. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
3. De, K.K.(2004). An Introduction to Plant Tissue Culture. New Central Book Agency (P.) Ltd. Kolkata.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Albert F Hill; O P Sharma (1996) Hills Economic Botany, New Delhi: Tata McGraw-Hill, ©1996.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.
7. Jha Timir Baran, Ghosh Biswajit (2016) Plant Tissue Culture: Basic and Applied Revised 2<sup>nd</sup> edition Platinum Publishers.

<b>Semester – II</b>	<b>Paper - V</b>
<b>Course Code: BSC-WBAT 205T</b>	<b>Title of the Course: Basic Biochemistry II</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (Cos)**

1. Students will understand the concepts and structure of nucleic acids.
2. Students will study the classification and functions of proteins.
3. Students will get fundamental knowledge on enzyme and their importance in biological reactions.
4. Students will study the classification and functions of vitamins in our body.

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topics</b>	<b>No of Hours</b>
<b>Unit-1</b>	<b>Nucleic Acids</b> <ul style="list-style-type: none"> <li>• Definition, Purine, Pyrimidines,</li> <li>• Nucleosides, Nucleotides, Polynucleotide, Phosphodiester bond</li> <li>• General structure of DNA and RNA.</li> </ul>	<b>6</b>
<b>Unit-2</b>	<b>Proteins:</b> <ul style="list-style-type: none"> <li>• Central dogma of protein synthesis</li> <li>• Amino acids and their Classification, zwitterion, titration of amino acid, Isoelectric pH</li> <li>• Protein structure: Primary structure and peptide bond formation, Secondary structure, Tertiary and Quaternary structure, secondary bonds in protein molecules.</li> <li>• Protein denaturation and renaturation.</li> <li>• Biological Functions of proteins</li> </ul>	<b>12</b>
<b>Unit-3</b>	<b>Enzymes:</b> <ul style="list-style-type: none"> <li>• Definition, general properties, co-factors- coenzymes and metal ions, Biocatalyst, Active site, ES complex, Specificity, Energy of activation, Reaction Rate, Enzyme units</li> </ul>	<b>8</b>

- Models for enzyme catalysis- Lock and key, Induced fit hypothesis
- Enzyme classification.
- Parameters affecting enzyme activity (enzyme concentration, temperature, pH, substrate concentration, activator, inhibitor)
- Enzyme inhibition- Irreversible and reversible
- Industrial applications of enzymes

**Unit-4 Vitamins: 4**

- Sources, deficiency diseases,
- Classification,
- Biochemical functions of fat soluble and water soluble Vitamins.

**Suggested Readings:**

1. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Fundamentals of Biochemistry. 3rd Edition, (2008), Donald Voet & Judith Voet, John Wiley and Sons, Inc. USA
3. Principles of Biochemistry, 4th edition (1997), Jeffery Zubey, McGraw-Hill College, USA
4. Biochemistry: 7th Edition, (2012), Jeremy Berg, Lubert Stryer, W.H. Freeman and company, NY.
5. Lehninger , Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.
6. Biochemistry. 5th Edition, (copu right 2013), Reginald Garrett and Charles Grisham, Brook/ Cole, Cengage Learning, Boston, USA.



<b>Semester – II</b>	<b>Paper - VI</b>
<b>Course Code: BSC-WBAT 206T</b>	<b>Title of the Course: Metabolic Pathways</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (Cos)**

1. Students will understand the concepts of metabolism and its regulation in body.
2. Students will learn the bioenergetics and free energy.
3. Students will study the carbohydrate metabolism.
4. Students will also understand the role of TCA in central carbon metabolism and importance of anaplerotic reactions and redox balance.
5. Students will learn the process and mechanism of fermentation.

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topics</b>	<b>No. of hours</b>
	<b>Metabolism:</b>	<b>8</b>
<b>Unit-1.</b>	<ul style="list-style-type: none"> <li>• Definitions &amp; Concepts: Catabolism, anabolism, anapleurotic reactions</li> <li>• Bioenergetics:</li> <li>• Concept of bioenergetics:</li> <li>• Concept of free energy,</li> <li>• Laws of thermodynamics and their relevance to metabolism.</li> <li>• Exothermic reactions and Endothermic reactions.</li> <li>• Concept of high energy bond &amp; high energy compounds.</li> </ul>	
<b>Unit-2.</b>	<b>Carbohydrate metabolism:</b> <ul style="list-style-type: none"> <li>• Glycolysis (E.M.P.)</li> <li>• Fates of pyruvate.</li> <li>• T.C.A. cycle.</li> <li>• Oxidative and substrate level phosphorylation</li> </ul>	<b>8</b>
	<b>Fermentation:</b>	<b>10</b>
<b>Unit-3.</b>	<ul style="list-style-type: none"> <li>• Overview of anaerobic respirations</li> <li>• Concept of Primary &amp; secondary metabolites with examples.</li> <li>• Biochemistry of Ethanol, Lactic acid, propionic acid, butanol production.</li> </ul>	

- Pasteur & Crabtree effect

**Regulation of metabolism:**

**4**

- Unit-4.** 4.1 Regulation at Enzyme level – feedback inhibition and its types.  
4.2 Enzyme regulation : Allosteric inhibition

**Suggested Readings:**

1. Deb A. C. (1999) Concepts of biochemistry (Theory and Practical)
2. Lehninger Albert L. (1984) Biochemistry
3. David L. Nelson and Michael M. (2005) Lehninger principles of Biochemistry
4. Fundamentals of biochemistry: Gurdeep P.Chaiwal and Sham K. Anand (2007) Industrial methods of chemical Analysis Deb A. C. (2004).

<b>Semester – II</b>	<b>Paper - VII</b>
<b>Course Code:</b> BSC-WBAT 207T	<b>Title of the Course:</b> Introduction to Beer, Wine and Alcohol Technology
<b>Credits:</b> 02	<b>Total Hours:</b> 30

### Course Outcomes (Cos)

1. Students will understand the concepts of Traditional and Commercial winemaking practices.
2. Students will learn the alcoholic beverages.
3. Students will study the organic wine, biodynamic wine and Amber wine.
4. Students will learn the working of barrels, its roasting and functions.

### Detailed Syllabus:

Unit No.	Topics	No. of Hours
<b>Unit-1</b>	<b>Concept of Alcoholic fermentation</b>	<b>8</b>
	<ul style="list-style-type: none"> <li>• Introduction, history of alcoholic fermentation</li> <li>• Various substrates used for alcoholic fermentation,</li> <li>• Basic terminologies associated with alcoholic fermentation</li> <li>• 1.4 Uses of alcohol</li> </ul>	
<b>Unit-2</b>	<b>Introduction and history of alcoholic beverages</b>	<b>10</b>
	<ul style="list-style-type: none"> <li>• Basic concept of alcoholic beverages – Beer, Wine, Vodka, Gin, Brandy, Whiskey, Rum, Carbonated drinks.</li> <li>• Alcoholic beverage and health: Faults of Alcoholic beverages, Effects on the human health.</li> <li>• Status of Indian brewing, winemaking and alcohol.</li> </ul>	
<b>Unit-3</b>	<b>Overview of Wine and Beer Production</b>	<b>12</b>
	<ul style="list-style-type: none"> <li>• Traditional and Commercial wine and beer making practices: A comparative study.</li> <li>• Raw materials used in wine and beer production</li> <li>• Additives used in wine and beer.</li> <li>• Equipments used in wine and beer production: crusher, press fermenter,</li> <li>• Pump, Miller, Beer fermenter etc.</li> <li>• Automation in wine and beer industry.</li> </ul>	

- New concept in wine and beer production – organic, biodynamic and Amber wine/beer

**Suggested Readings:**

1. Vine, Richard P. (1997) Wine Appreciation.
2. Emile Peynavd (1997) The taste of wine.
3. Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and production.
4. C. S. Ough (1992) Wine making Basics.

<b>Semester – II</b>	<b>Paper - VIII</b>
<b>Course Code: BSC-WBAT 208T</b>	<b>Title of the Course: Sensory Evaluation of Wine-II</b>
<b>Credits: 02</b>	<b>Total Hours: 30</b>

**Course Outcomes (Cos)**

1. Students will understand the concepts of good and spoiled wines.
2. Students will learn the types as well as styles of wines.
3. Students will study different corks used for wine bottles.
4. Students will learn to organize tasting sessions of wines and marking systems of wines.

**Detailed Syllabus:**

<b>Unit No.</b>	<b>Topics</b>	<b>No ofHours</b>
<b>Unit-1</b>	<ul style="list-style-type: none"> <li>• Types of wines: Red, White, Rose, Sparkling, Dessert, Fortified</li> <li>• Styles of wine</li> <li>• Spoilage of wine: off odors in wine and off tastes in wines</li> <li>• New trends in the world of wine: New world and old world wines</li> <li>• Advantages and disadvantage of different closure (Screw cap, cork, Zork, synthetic cork, vino seal and crown caps) used for wine bottles.</li> </ul>	<b>10</b>
<b>Unit-2</b>	<ul style="list-style-type: none"> <li>• Chemical constituents of grapes and wines: Sugar, Acids, Phenolics and Alcohol.</li> <li>• Types of Wine Additives</li> <li>• Introduction to tasting sheet: White wine.</li> <li>• Introduction to tasting sheet: red wine.</li> <li>• Introduction to tasting sheet: sparkling wine.</li> <li>• Matching wine with food: Theory of food combination such as sweet, sour, salty and spicy food with wine.</li> </ul>	<b>10</b>

**Unit-3****10**

- Pre- tasting organization – testing area, number of samples replicates, temperature, cork removal, decanting, dispensers, glasses, number of tasters.
- Tasting situations – wine competitions, trade tasting, wine appreciation courses,home tasting.
- Tasting exercises – Duo –trio test, blind tasting, triangular taste.
- Wine and health: Beneficial and harmful effects of wine on the human health.

**Suggested Readings:**

1. Brue W. Zoecklein, Kenneth Fugelsang, Barry H. Gump Fred S. Nury (1999) Wine Analysis and Production.
2. C. S. Ough (1992) Wine making Basics
3. Roger B.Boulton (1996) Principles and practices of wine making
4. Emile Peynalld (1984) Knowing & making wine
5. Patrice Iland and Peter Gago (1997) Australian wine from the grasp vine to the glass.

<b>Semester – II</b>	<b>Paper - IX</b>
<b>Course Code: BSC-WBAT 209P</b>	<b>Title of the Course: Practicals in Microbiology</b>
<b>Credits: 1.5</b>	<b>Total Hours: 4 5</b>

### Course Outcomes (Cos)

1. Students will learn the bacteria isolation techniques.
2. Students will learn the fungi isolation techniques.
3. Students will study different staining techniques used in microbiology.
4. Students will learn the inoculum preparation and preservation of microbial cultures.

### Detailed Syllabus:

<b>Sr. No.</b>	<b>Experiment Title</b>	<b>No. of Practicals</b>
1.	Isolation of bacteria and yeast from natural sources.	1
2.	Observation of the growth of cultures and reporting of colony and cultural characteristics (Nutrient agar, Sabouraud's agar)	1
3.	Isolation of microorganism by streak plate method	1
4.	Isolation of microorganism by spread plate method	1
5.	Isolation of microorganism by pour plate method	1
6.	Yeast for enumeration of yeast by Neubauer's chamber.	1
7.	Basic staining techniques: i) Monochrome staining ii) Negative staining.	1
8.	Special staining techniques: Gram staining for differentiation of bacteria	1
9.	Staining of Endospore and Capsule	1
10.	Preservation of cultures on slants.	1
11.	Enumeration of bacteria by spectrophotometry	1
12.	Inoculum development of yeast	1

### Suggested Readings:

1. P. Gunasekaran (2005) Laboratory Manual in Microbiology
2. Stanbury, P. F., Whitaker A. & Hall S. T. (2008) Principles of Fermentation Technology

3. Anuradha De. (2009) Practical and applied microbiology
4. John Grainger (2001) ,Basic practical microbiology Panda U. N. (2005) Handbook of Microbiology and parasitology
5. Anuradha De. (2009) Practical and applied microbiology
6. Prescott Hurley Kline's (2008) Microbiology
7. Sathe S. T. Pharande S. R. (2010) Introduction to Microbiology



<b>Semester – II</b>	<b>Paper - X</b>
<b>Course Code: BSC-WBAT 210P</b>	<b>Title of the Course: Practicals in Botany</b>
<b>Credits: 1.5</b>	<b>Total Lectures: 45</b>

### Course Outcomes (Cos)

1. Students will learn the concept of osmosis, diffusion pressure and turgor pressure using potato tubers.
2. Students will study extraction and spectrophotometric estimation of leaf pigments.
3. Students will learn the organization of tissue culture laboratory.
4. Students will learn tissue culture techniques

### Detailed Syllabus:

<b>Sr. No.</b>	<b>Experiment Title</b>	<b>No. of Practicals</b>
1.	Study of osmosis and turgor pressure	1
2.	Determination of Diffusion Pressure Deficit using potato tubers.	1
3.	Study of transpiration and translocation in plants.	1
4.	Testing presence of phenols in the plant tissue by ferric chloride test.	1
5.	Separation of leaf pigments by paper strip chromatography	1
6.	Extraction and Spectrophotometric estimation of leaf pigments	1
7.	Preparation of nursery beds and rising of plants by natural reproductive organs	1
8.	Rising of plants by Artificial methods (Layering, Grafting and Budding)	1
9.	PTC Laboratory: organization of facility and equipment,	1
10.	Stock solutions and media preparation	1
11.	Aseptic manipulation – washing, capping, packing & sterilization, laminar flow operation and safety precautions, Explant preparation etc.	1
12.	Initiation of shoot tip and axillary bud culture	1

### Suggested Readings:

1. Roy Pijush (2012). Plant Anatomy. New Central Book Agency (P.) Ltd. Pune
2. Vasishta, P.C. (1981). Plant Anatomy to embryology. Pradeep Publications

3. Gokhale, S.B. and Kokate, C.K. (1987). Pharmacognosy
4. Wallis, T.E. (1985). A Text book of Pharmacognosy, CBS Publishers & Distributors, New Delhi
5. Sadhu, M.K. (1989). Plant Propagation. Wiley Eastern Ltd. New Delhi.
6. De, K.K. (2004). An Introduction to Plant Tissue Culture. New Central Book Agency (P.) Ltd. Kolkata.

<b>Semester – II</b>	<b>Paper - XI</b>
<b>Course Code: BSC-WBAT 211P</b>	<b>Title of the Course: Practicals in Biochemistry</b>
<b>Credits: 1.5</b>	<b>Total Hours: 45</b>

**Course Outcomes (Cos)**

1. Students will learn the extraction and estimation of protein by Biuret and Folin Lowry methods.
2. Students will study how to determine chlorine content and alkalinity in water.
3. Students will learn the different assays, paper chromatography technique.
4. Students will learn the estimation of ethanol and ascorbic acid.

**Detailed Syllabus:**

<b>Sr. No.</b>	<b>Experiment Title</b>	<b>No of Practicals</b>
1	Qualitative tests for amino acids and Proteins	1
2	Determination of $\lambda_{max}$ for protein or nucleic acid	1
3	Preparation of buffers.	1
4	Protein estimation-Biuret method	1
5	Protein estimation-Folin Lowry method	1
6	Determination of enzyme activity (amylase)	1
7	Effect of pH/inhibitor on enzyme activity.	1
8	Paper chromatography of amino acids	1
9	TLC of amino acids	1
10	To determine $T_m$ of DNA	1
11	Estimation of ethanol by CAN method	1
12	Determination of Ascorbic acid	1

**Suggested Readings:**

1. An Introduction to Practical Biochemistry. 3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu. Pvt. Ltd. New Delhi, India

2. Biochemical Methods.1st, (1995), S. Sadashivam, A. Manickam, New Age International Publishers, India
3. An introduction to practical biochemistry, David plummer
4. Introductory practical biochemistry, S.K. Sawhoey, Randhir singh

<b>Semester – II</b>	<b>Paper - XII</b>
<b>Course Code: BSC-WBAT 212P</b>	<b>Title of the Course: Practicals in Wine Technology</b>
<b>Credits: 1.5</b>	<b>Total Hours: 45</b>

**Course Outcomes (Cos)**

1. Students will understand the scorecards used for determination of quality of wines.
2. Students will study effect of different factors such as serving temperatures and pH on wines.
3. Students will learn the concept of matching wine with food.
4. Students will learn the 6S tasting technique of wine and its sense of feel.

**Detailed Syllabus:**

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

**Suggested Readings:**

1. Ronald S. Jackson (2002) Wine Testing a professional handbook
2. Ron s. Jockson (2000) Wine science principles practices & perception
3. Vine, Richard p (1997) Wine Appreciation
4. Emile Peynavd (1997) The taste of wine