DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

CIRCULAR NO.SU/SCIENCE & TECHNOLOGY STUDIES/SYLL./B.VOC./78/2022.

It is hereby informed to all concerned that, on the recommendation of Ad-hoc Board in Vocational Studies and Dean, Faculty of Science & Technology the Hon'ble Vice-Chancellor has **accepted the curriculum of following B.Voc. Courses under Choice Based Credit and Grading System in** his emergency powers under Section-12 [7] of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith:

Sr.No.	Course Name	Semester
1	B.Voc in Software Development	(I & II)
2	B.Voc in Medical Laboratory Technology	(I & II)
3	B.Voc in Muitimedia & Animation- Structure & syllabus [New]	(Sem-I to VI)
4	B.Voc in Muitimedia & Animation [old]	(Sem-V&VI)
5	B.Voc in Organic Agriculture	(Sem-V &VI)
6	B.Voc in Bioproducts Technician	(Sem-I to VI)
7	M.Voc in Food Processing Technology	(Sem-I to IV)

This is effective from the **Academic Year 2020-21 and 2021-22** and onwards. This curriculum is also available on the University website www.bamu.ac.in.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Aurangabad-431 004.
Ref. No.SU/B.voc./Curri./2021-22

Date: 20.01.2022

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Deputy Registrar,
Academic [Syllabus]
Section.

Copy forwarded with compliments to :-

Copy forwarded with compliments to :-

1] **The Principal All Affiliated Concerned Colleges, Dr.Babasaheb Ambedkar Marathwada University, Aurangabad.**
2] **The Director,** University Network & Information Centre, UNIC, with **a request to upload the curriculum along with this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.BAMU, A'bad
2] The Concerned Section, Examination Branch,
3] The Section Officer, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations, section, Dr.BAMU, A'bad
5] The Programmer [Computer Unit-2] Examinations, section, Dr.BAMU, A'bad
6] The In-charge, [E-Suvidha Kendra],
7] The B.Voc Section, Dr.BAMU,A'bad
8] The Public Relation Officer,
9] The Record Keeper,

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY AURANGABAD

SYLLABUS OF
BACHELOR OF VOCATIONAL
IN

B.Vov in - Bioproducts Technicion

SEMESTER- I & VI

Choice Based Credit System

Effective form the Academic Year
2020-21 and 2021-22 & Onwards

NAAC Re-accredited 'A' Grade
ISO 9001 : 2008 Certified
College with Potential for Excellance

Marathwada Shikshan Prasarak Mandal's

DEOGIRI COLLEGE

Aurangabad - 431 005, Maharashtra, India

Esta. : 1960

C.N. EF0BDE/0BDE : 1215

Affiliated to : Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
Centre No. : Senior - 003 Junior - 101
Jr. Index No.: 56-01-001 U-DISE No. : 27191109505

I/c. PRINCIPAL
Prof. Ashok Tejankar
M.Sc. Ph.D.

Phone : 0240-2367333, 2367330 I Fax : 0240 - 2367301
Website : www.deogiricollege.org
E-mail : principal@deogiricollege.org I deogiri@mspmandal.in

DCA/2021-2022/882

दि. 28/10/2021
28/10/2021

To,

The Deputy Registrar,

Academic section,

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad.

डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ शैक्षणिक विभाग 1402 30/10/2021 औरंगाबाद

Subject: Regarding to submission of B.Voc. Bioproducts Technician Semester I to Semester VI curriculum.

Respected Sir,

As per above cited subject, we have designed curriculum of B.Voc. Bioproducts Technician as per uniform B.Voc. Curriculum guidelines provided by Dr.BAMU, Aurangabad. Curriculum was designed under the guidance of subject experts. The implementation of this revised syllabus for academic year 2021-22 progressively. So, kindly accept & process this curriculum for approval & implementation for academic year 2021-2022.

Thanking you.

Principal
Principal
Deogiri College
Aurangabad

Enclosed: Curriculum (3 yrs I to VI Semester)

Syllabus

Smt. Hiwarale

2021-22

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS)

Curriculum Structure

Bachelor of Vocation

B.VOC. (Bioproducts Technician)

(Faculty of Science and Technology)

Choice Based Credit System

(Effective from 2021-22)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(MS) Uniform Pattern for Bachelor of Vocation (B.VOC) Program

Faculty of Science and Technology,
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(W.E.F Academic Year 2021-22)

Appooved.

SEMESTER - I							
Sr. No.	Subject Code	Title of the Subject	Contact Hours Per Week		Evaluation Scheme (marks)		Credit
			L	P	CIA	SEE	
General Academic Components							
1	BVBPT-111	Functional English	4	0	20	80	4
2	BVBPT-112	Basic Biology-I	4	0	20	80	4
3	BVBPT-113	Basic Chemistry-I	4	0	20	80	4
Skill Development Components							
4	BVBPT-114	Analytical Techniques	4	0	20	80	4
5	BVBPT-115	Basic Biochemistry	4	0	20	80	4
6	BVBPT-116	LAB: Based on Analytical Techniques	0	6	25	25	3
7	BVBPT-117	LAB: Based on Basic Biochemistry	0	6	25	25	3
8	BVBPT-118	Basic Microbiology	4 Lectures/ 100 hrs. Industrial Certification		20	80	4
				Total	170	530	30

20/07/22

SEMESTER - II							
Sr. No.	Subject Code	Title of the Subject	Contact Hours Per Week		Evaluation Scheme (marks)		Credit
			L	P	CIA	SEE	
General Academic Components							
1	BVBPT-121	Computer Skills	4	0	20	80	4
2	BVBPT-122	Basic biology-II	4	0	20	80	4
3	BVBPT-123	Basic Chemistry-II	4	0	20	80	4
Skill Development Components							
4	BVBPT-124	Applied Thermodynamics	4	0	20	80	4
5	BVBPT-125	Fermenter Design-I	4	0	20	80	4
6	BVBPT-126	LAB: Based on Industrial media and energy balance	0	6	25	25	3
7	BVBPT-127	LAB: Based on operation of fermentation process	0	6	25	25	3
8	BVBPT-128	Applied Microbiology	4 Lectures/ 100 hrs. Industrial Certification		20	80	4
				Total	170	530	30

SEMESTER - III							
Sr. No.	Subject Code	Title of the Subject	Contact Hours Per Week		Evaluation Scheme (marks)		Credit
			L	P	CIA	SEE	
General Academic Components							
1	BVBPT-231	Energy and Environment	4	0	20	80	4
2	BVBPT-232	Biostatistics	4	0	20	80	4
3	BVBPT-233	Central Dogma	4	0	20	80	4
Skill Development Components							
4	BVBPT-234	Fermenter Design-II	4	0	20	80	4
5	BVBPT-235	Fundamentals of food technology	4	0	20	80	4
6	BVBPT-236	LAB: Based on Fermenter Design-II	0	6	25	25	3
7	BVBPT-237	LAB: Based on Fundamentals of food technology	0	6	25	25	3
8	BVBPT-238	Upstream Process	4 Lectures/ 100 hrs. Industrial Certification		20	80	4
				Total	170	530	30

SEMESTER - IV							
Sr. No.	Subject Code	Title of the Subject	Contact Hours Per Week		Evaluation Scheme (marks)		Credit
			L	P	CIA	SEE	
General Academic Components							
1	BVBPT-241	Personality Development and Stress Management	4	0	20	80	4
2	BVBPT-242	Recombinant DNA Technology	4	0	20	80	4
3	BVBPT-243	Enzyme Technology	4	0	20	80	4
Skill Development Components							
4	BVBPT-244	Fermentation process and control	4	0	20	80	4
5	BVBPT-245	Downstream process	4	0	20	80	4
6	BVBPT-246	LAB: Based on Biomass	0	6	25	25	3
7	BVBPT-247	LAB: Based on RDT & Enzyme Technology	0	6	25	25	3
8	BVBPT-248	Plant Breeding	4 Lectures/ 100 hrs. Industrial Certification		20	80	4
				Total	170	530	30

SEMESTER – V							
Sr. No.	Subject Code	Title of the Subject	Contact Hours Per Week		Evaluation Scheme (marks)		Credits
			L	P	CIA	SEE	
General Academic Components							
1	BVBPT-351	Human Resource Management	4	0	20	80	4
2	BVBPT-352	Growth Energetic	4	0	20	80	4
3	BVBPT-353	Elective : (a) Animal cell culture technology & transgenic animals (b)Post-production cleaning & maintenance	4	0	20	80	4
Skill Development Components							
4	BVBPT-354	Elective : (a) Bioprocess monitor & Control (b) Neutraceuticals	4	0	20	80	4
5	BVBPT-355	Practicals based on Neutraceuticals	0	8	25	25	4
6	BVBPT-356	Off Campus Industrial/Institutional Training/Field Survey	#		50	125	6
7	BVBPT-357	Major Project - I	0	6	50	50	3
8	BVBPT-358	Seminar	0	2	25	00	1
Total					230	520	30

SEMESTER – VI							
Sr. No.	Subject Code	Title of the Subject	Contact Hours Per Week		Evaluation Scheme (marks)		Credits
			L	P	CIA	SEE	
General Academic Components							
1	BVBPT-361	**Entrepreneurship Development**	4	0	20	80	4
2	BVBPT-362	**Bioethics & IPR**	4	0	20	80	4
3	BVBPT-363	**Elective:** **(a) Supply chain & enterprise resource planning in Biomanufacturing** **(b) Methods in quality improvement, investigations & Audits**	4	0	20	80	4
Skill Development Components							
4	BVBPT-364	**Elective :** **(a) Documentation & Record keeping** **(b) Bioremediation Technology**	4	0	20	80	4
5	BVBPT-365	**Bioenergy production**	4	0	20	80	4
6	BVBPT-366	**Off Campus Industrial/Institutional Training/Field Survey**	#		20	80	4
7	BVBPT-367	**Major Project – II, Report and Seminar**	0	12	100	100	6
Total					220	580	30

Note:

1. **Particular Subject Title**, run under the specific skill sector of B.VOC program, should replace the following common nomenclature mentioned in course structure –

- **Specific Course on generic organizational practice**

  Institute/College should offer basic/applied course that creates overall background for career in organization/industry/domain in specific skill sector

B.Voc.
(Bioproducts Technician)
First Year
Semester-I

BVBPT111: Functional English

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To provide students with fundamental backgrounds of communicative English.

COURSE OUTCOMES:

On completion of the course, students should be able to —

- Apply grammatical tools to formulate correct sentences in English.
- Apply concept of tenses to formulate correct sentences in English.
- Formulate different types of dialogues, expression of ideas/information in English
- Compose applications, reports, requests, responses, summary and comprehensions in English

Course Contents:

Unit l: Functional Grammar Elements **(12 Hrs.)**

Recapitulation of Grammar — Noun, Verb (Classifications), Infinitive and Gerunds, Auxiliaries and Modals, Passivity, Conditionals, Concord, Articles, Conjunction, Prepositions, Pronouns, Adverbs; Active and Passive Voice; Question Tag

Unit2: Tenses **(12 Hrs.)**

Present Tense, Past Tense, Future Tense (all four types to be included in each)

Unit3: Sentence Formation **(12 Hrs.)**

Types of Sentences — Simple, Complex, Compound; Phrases; Clauses; Synthesis of Sentences; Transformation of Sentences; Direct and Indirect Speech

Unit 4: Basic Verbal Communications **(12 Hrs.)**

Introducing yourself (The communicator); introducing people toothers; Giving Personal information; Getting people's attention and interrupting; Giving instructions and Seeking clarifications; Making requests and responding to requests

Unit 5: Basic Writing Skill **(12 Hrs.)**

Writing Notices; Drafting Agendas; Writing minutes; Note taking; Writing applications for various jobs, referring to threads. Writing summary; Writing advertisements

Reference Book/Link:

High School Grammar and Composition; Wren and Martin; Fifteenth Edition; BlackieElt Books; India; ISBN- 978-8 1-219-0009-6

Synergy: Communication in English and Study Skills; Board of Ed.; 2008; Orient Black swan; India

ISBN- 978-81-250-3577-0

Business Communicator — V.K. Jain, O. P. Biyani, S. Chand, New Delhi.

Suggested Reading:

Macmillan Foundation English — R. K. Dwivedi, A. Kumar: Macmillan India Ltd.2001

BVBPT112: Basic Biology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The student will be able to read, understand, and critically interpret the primary biological literature in his/her area of interest.
- The student will be able to design, conduct, analyze, and communicate (in writing and orally) biological research.

COURSE OUTCOMES:

- Students will be able to explain the basic concepts of biology.
- Students will learn a variety of skills necessary to function as a biologist in the workplace.
- Students will demonstrate the ability to articulate, verbally and in writing knowledge of biology, biological methods, and biological issues in context.

Course Contents:

UNIT-I **(12 Hrs.)**

Classification of Organisms Classification of organisms (Binomial system), Species, Species name, taxonomic hierarchy. Three Domains of life- Archaebacteria, Eubacteria, Eukarya, Five Kingdom classification, Viruses – a special case as exception.

UNIT-II **(12 Hrs.)**

Bacteria; Prevalence of bacteria, bacterial forms, basic structure (surface and interior), Bacterial Diversity, Classification of bacteria, Importance of bacteria.

UNIT-III **(12 Hrs.)**

Plant Kingdom, Histology, Tissue types - Meristematic, permanent, Types of Vascular Bundles, Stelar types and evolution, Plant physiology.

UNIT-IV **(12 Hrs.)**

Animal cell structure & function, Nutrition and digestion, Gas exchange, Circulation, Immune System, homeostasis, hormones and endocrine systems, reproduction & embryonic development, Nervous system, Motion, Sense organs.

UNIT-V **(12 Hrs.)**

Origin and Evolution of life Origin of life, Evolution of life forms, Evidences of evolution, Mechanism of evolution, Hardy - Weinberg Principle, A brief account on evolution.

Reference Book/Link:

1. Brock Biology of Microorganisms - Madigan et al, 9th ed.
2. Biology by Raven and Johnson
3. Biology by Campbell and Reece
4. Exploring creation with Biology – Wile and Durnell.

BVBPT113: Basic Chemistry

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

After studying this lesson your students will be able to:

- The aim of this course is to develop better understanding of basic principles of chemistry including organic, inorganic and physical chemistry.
- To study classification and nomenclature of organic compounds in trivial and IUPAC system.
- To develop understanding of different types of spectroscopy and their applications, methods of purification of organic compounds.
- To study the range and chemistry of elements in periodic table and their compounds.

COURSE OUTCOMES:

- The student will learn the laboratory skills needed to design safely conduct and interpret the chemical research.
- The student will have ability to understand the mechanisms used to predict the products of organic chemical reactions.
- The student will learn and apply basic techniques used in organic laboratory for preparation, purification and identification of organic compounds.
- The student will develop the ability to present scientific and technical information resulting from laboratory experimentation in both written and oral formats.

UNIT-I **(12 Hrs.)**

Importance of chemistry, types of organic compounds, Reaction mechanisms.

UNIT-II **(12 Hrs.)**

Importance of Chemistry, basic physical quantities and their measurements, SI Units, Dimensional Analysis, matter and its nature, atomic and molecular masses, molar masses, laws of chemical combinations, molecular formula.

UNIT-III **(12 Hrs.)**

IUPAC nomenclature system purification methods, composition of organic compounds.

UNIT-IV **(12 Hrs.)**

Long form of periodic table: - Mosley's modern periodic law extended periodic table, classification elements, predication of period group and block of a given element.

UNIT-V **(12 Hrs.)**

Spectroscopy: - Concept and principal of spectroscopy, Electromagnetic radiations types of spectroscopy and their applications.

Reference Books/Links:

1. Organic Chemistry by Bahl and Bahl.

2. Reaction and recovery of chemicals by S. N. Sanyal.

3. Inorganic chemistry by J.D.Lee.

4. J. March: Advanced Organic Chemistry

BVBPT114: Analytical techniques

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objective of this paper to understand principle, working mechanism and application of pH meter, microscope, calorimeter, electrophoresis, Chromatography, centrifugation, flow cytometer.

COURSE OUTCOMES:

- At the end of the course, the students will have sufficient scientific understanding of the basic concepts in instrumentation used characterization of bioproducts.

Course Contents:

UNIT-I **(12 Hrs.)**

Basic Laboratory Instruments: Principle and working of pH meter, autoclave, HAO laminar air flow.

UNIT-II **(12 Hrs.)**

Microscopy: Microscope Types: Light and electron, Resolving power, Numerical aperture, limit of resolution, magnification, principle, working, ray- diagram and applications of bright field, dark field, fluorescent and phase contrast microscopy, Transmission and scanning electron microscopy

UNIT-III **(12 Hrs.)**

Centrifugation- types, preparative, analytical and differential, sedimentation velocity and sedimentation equilibrium.
Electrophoresis: Basic principle of electrophoresis theory and applications of paper and gel electrophoresis.

UNIT-IV **(12 Hrs.)**

Chromatographic Techniques: Theory, Principle and applications of Thin layer chromatography, paper chromatography, Ion exchange, chromatography, affinity chromatography and HPLC.

UNIT- V **(12 Hrs.)**

Flow cytometry: Principle, working, instrumentation and applications of a flow cytometer.

Reference Books/Links:

1. Biophysical Chemistry by Nath and Upadhya.
2. Practical biochemistry principles and techniques by Wilson and Walker.
3. Instrumental methods of chemical analysis by Chatwal and Anand.
4. Lab Manual in Biochemistry by J. Jayaraman.
5. Chromatography: Concepts and Contrasts- 1988 James Miller, John Wiley and Sons, Inc.
6. Analytical Biochemistry by Holme

BVBPT115: Basic Biochemistry

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis. To study and understand the structures and properties of substances consisting the framework of cell and tissues.
- The course aims to provide students with an advanced integrated knowledge and understanding of core topics, with general principles set in particular contexts.
- To study the manifold energy-requiring process of the living cell.

COURSE OUTCOMES:

- Students will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules, metabolic pathways, and the regulation of biological/biochemical processes.
- Biochemistry majors will gain proficiency in basic laboratory techniques in both chemistry and biology, and be able to apply the scientific method to the processes of experimentation and hypothesis testing.
- Students in the Biochemistry Major will be able to apply and effectively communicate scientific reasoning and data analysis.
-

Course Contents:

UNIT-I **(12 Hrs.)**

Introduction to biochemistry, its scope, significance and applications. pH, pKa,Buffers, H.H. equation.

UNIT-II **(12 Hrs.)**

Definition, classification, structure, function and properties of monosaccharide, Disaccharide and polysaccharide

UNIT-III **(12 Hrs.)**

Amino acids: - classification, structure, general reactions of amino acids. Proteins: - classification, bonds involved in protein (peptide bond, disulphide bond, ionic bond, hydrogen bond, hydrophobic bond), structure of proteins.

UNIT-IV **(12 Hrs.)**

Classification, structure of saturated and unsaturated fatty acids, properties and biological function of lipids.

UNIT- V **(12 Hrs.)**

Classification, structure, physio-chemical properties and types of nucleic acids.

Reference Books/Links:

1. Outline of Biochemistry-By Cohn and Stump

2. Biochemistry-By Lubert Stryer

3. Principles of Biochemistry-By Lehringer

4. Biochemistry-By Zubay

5. Harper's review of Biochemistry

BVBPT116: LAB: Based on Analytical Techniques

Credit: 3 **Marks: 50**

List of Practical based on Analytical Techniques

1. Study of titration curve of acetic acid & determination of pKa.
2. Study of UV-absorption spectra of macromolecules (Nucleic acid & protein).
3. Determination of λ max of given dye solution.
4. Spectrophotometric determination of nucleic acid purity & concentration.
5. Separation & identification of amino acids using TLC & paper chromatography.
6. Separation & Identification of sugars using paper chromatography.
7. Separation & Identification of lipids by TLC.
8. Separation of serum proteins by gel electrophoresis.

BVBPT117: LAB: Based on Basic Biochemistry

Credit: 3 **Marks: 50**

List of Practical based on Basic Biochemistry:

1. Qualitative test for Carbohydrates.
2. Estimation of Carbohydrates by using Anthrone method.
3. Estimation of reducing sugar by Sumner's method.
4. Qualitative test for protein and amino acids.
5. Estimation of protein by Folin-Lowry method.
6. Estimation of protein by Biuret method.
7. Estimation of Vitamin C.
8. Preparation of buffers.
9. Estimation of DNA.
10. Estimation of RNA.
11. Estimation of amino acids.

BVBPT118: Basic Microbiology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The study of microbes helps us to understand our world and our place within it.
- It gives us insights into the complexity of nature and society, which in turn provide much different health, environmental, social, cultural, industrial and economic benefits.
- Microbiology is the study of organisms that are too small to be observed with the naked eye. Microorganisms include algae, bacteria and fungi

COURSE OUTCOMES:

- Students will be able to acquire and apply specialized language and knowledge relevant to microbiology.
- Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.

Course Contents:

UNIT-I **(12 Hrs.)**

Introduction, History of Microbiology, Overview of Microbial Taxanomy. General Characteristics and applications of different microbial groups- Fungi, Algae, Actinomycetes

UNIT-II **(12 Hrs.)**

Ultrastructure of Bacterial Cell, Structure of Endospore, Stages of Sporulation and Germination of endospore. Bacterial Toxins

UNIT-III **(12 Hrs.)**

Microbial Growth, Concept of Microbial Growth, Continuous and Batch Culture. Monoauxic , Diauxic and Synchronous Growth. Bacterial Growth Curve. Generation Time. Methods of Synchronisation.

UNIT-IV **(12 Hrs.)**

Viruses and Fungi- Overview of structure and classification.

UNIT- V **(12 Hrs.)**

General characteristics of viruses. Plant viruses. Fungi of industrial importance.

Reference Books/Links:

1. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.
2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology Mc Graw Hill Book R. Krieg, 1986 Company
3. Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R. 1986 The Microbial world, 5th edition. Eagle Works Cliffs N.J. Prentica Hall.

B.Voc.
(Bioproducts Technician)
First Year
Semester-II

BVBPT121: Computer Skills

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To facilitate the students to study basic computer skills using application software tools,
- To facilitate the students to make functional use of computer skills in teaching - Learning and day to day occupational necessities.

COURSE OUTCOMES:

On completion of the course, students should be able to —

- Extend the knowledge of basic and advanced tools of Word Processing, Spreadsheet, Presentation Graphics, DBMS, and Internet in MS-Office for specific tasks
- Apply Word Processing tools to create Notice, Application
- Use Spreadsheet tools to create and manage attendance sheets

Course Contents:

UNIT-I: Word Processing **(12 Hrs.)**

Overview of Word Processing Creating and Editing a Document (Exercise | - Creating Notice) Revising and Refining a Document (Exercise 2 —Revising notice) Using Additional MS Word Features (Exercise 3 — Creating notice for different classes) Changing the Display of the Document (Exercise 4 - Changing the display of your notice) Using Standard Templates (Exercise 5—Create notice using standard templates) Using Mail Merge (Exercise 6 — Apply mail merge to send a notice)

UNIT-II: Spreadsheet Applications **(12 Hrs.)**

Overview of Excel
Creating and Editing (Exercise 1 — Creating attendance sheet)
Using Charts (Exercise 2 — Creating a chart) Managing a Workbook (Exercise 3 — Managing Attendance Sheet) Using of Basic mathematical Formulae (Exercise 4 — Application of basic mathematical formulae) Sorting and Filtering of data in a workbook

UNIT-III: Presentation Graphics **(12 Hrs.)**

Overview of Presentation Graphics
Creating a Presentation (Exercise 1 — Creating a Annual Day Presentation)
Modifying and Refining a Presentation (Exercise 2 — Modifying and Refining Presentation)
Using Advanced Presentation Features (Exercise 3 — Advanced Features for Presentation)

UNIT-IV: Database Management Systems **(12 Hrs.)**

Overview: Creating a Database (Exercise 1 — Creating a Student Database)
Modifying a Table (Exercise 2 — Modifying a Student Database)
Creating Forms (Exercise 3 — Creating Form for Student Database)
Queries and Reports (Exercise 4 — Creating Report)
Protecting the Database (Exercise 5 — Protecting a Student Database)

Unit-V: Internet **(12 Hrs.)**

Internet Basics
Navigating the Web (Exercise 1 - Navigating the website)
Finding Information on the Web (Exercise 2 - Searching result on the web)
Communication Using E-Mail (Exercise 3 - Communicate result to your friends)
Sending SMS through Web (Exercise 4 - Communicate through SMS through Web service)
Creating a Blog (Exercise 5 - Creating a blog using Wordpress.com)

Reference Books/Links:

1. Microsoft Office Word 2007 a Beginners Guide: A Training Book of Microsoft Word 2007, By W.R. Mills, United States of America, Bloomington, Indiana.
2. Microsoft Office Excel 2007: Comprehensive Concepts and Techniques, By Greg B. Shelly, Thomas J. Cashman, Jeffrey J.Quasney.
3. Microsoft Office Power Point 2007: Illustrated Introductory: Introductory, By David Beskeen Microsoft Office Access 2007: Comprehensive Concepts and Techniques, By Thomas J. Cashman,PhilipJ.Pratt
4. Basic Internet, By O.H.U.Heathcote

BVBPT122: Basic Biology-II

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Students will understand how these cellular components are used to generate and utilize energy in cells.
- Students will understand the cellular components underlying mitotic cell division.
- Students will understand the major components of Animal & Plant physiology.

COURSE OUTCOMES:

- Be able to evaluate scientific information regarding animal and plant physiology and molecular biology, and summarize scientific papers in the fields of animal and plant physiology.
- Use their knowledge about organs, organ structure and different cell types to explain and describe the specialized functions and regulations of the major organs and organ systems in the animal kingdom.

Course Contents:

UNIT-I **(12 Hrs.)**

Cell cycle, Phases of cell cycle, Binary fission and Budding, Mitosis, Significance of mitosis, Meiosis, Significance of meiosis.

UNIT-II **(12 Hrs.)**

Absorption of water and nutrients, Translocation of solutes, Transpiration, Photosynthesis, Photorespiration, Respiration.

UNIT-III **(12 Hrs.)**

Plant growth, Differentiation, Dedifferentiation, Dedifferentiation, Development of plant, Plant hormones, Photoperiodism, Vernalisation.

UNIT-IV **(12 Hrs.)**

Absorption, Digestion, Circulatory system, Respiratory system, excretory system, and Nervous system, Hormonal co-ordination.

UNIT- V **(12 Hrs.)**

Bacterial recombination (Conjugation, Transformation, Transduction), Sporulation, Adaptations with respect to extreme environments.

Reference Books/Links:

1. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 5th Ed, W. H. Freeman & Co, 2002.

2. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, Macmillan Worth, 2000.

BVBPT123: Basic Chemistry-II

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The aim of this course to develop understanding of fundamental properties of atoms molecules and the various states of matter.
- To understand preparation of solutions simple chemicals kinetics including zero, first and second order rate laws.
- To study and understand calculation of oxidation numbers, identification of redox reactions, oxidation reduction reactions, oxidizing and reducing agent.

COURSE OUTCOMES:

- The student will have ability to perform a various basic procedures in the chemistry lab including weighing samples, titration, and solution preparation.
- The student will have ability to keep accurate and detailed records of what was done during experiments.
- The student will develop the ability to present scientific and technical information resulting from laboratory experimentation in both written and oral formats.

Course Contents:

UNIT-I **(12 Hrs.)**

Concept of atom, molecule, mole concept, empirical and molecular formulae, atomic and molecular masses, nature of matter subatomic particles, quantum numbers, electronic configuration of elements, types of bonds.

UNIT-II **(12 Hrs.)**

Concept of solution, methods of expressing concentration, colligative properties of solutions, rate of chemical reaction and units, factors affecting rate of reaction.

UNIT-III **(12 Hrs.)**

Order and molecularity of reaction.

UNIT-IV **(12 Hrs.)**

Oxidation number, oxidation state, rules for calculating oxidation number, concept of oxidation, reduction

UNIT- V **(12 Hrs.)**

Redox reaction, oxidising and reducing agents, gravimetric and volumetric analysis (titration)

Reference Books/Links:

1. Physical Chemistry by Bahl and Bahl.
2. Physical Chemistry by G. M. Barrow.
3. Physical Chemistry by Lewis.
4. Inorganic chemistry by J. D. Lee.

BVBPT124: Applied Thermodynamics

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behaviour and performance.

COURSE OUTCOMES:

- Upon completion of this course, the students can able to apply the Thermodynamic Principles to Bioproducts technician.
- Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures

Course Contents:

UNIT-I **(12 Hrs.)**

Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT- II **(12 Hrs.)**

Second law of thermodynamics, Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. entropy change for – pure substance, ideal gases – different processes, principle of increase in entropy. Applications of II Law.

UNIT- III **(12 Hrs.)**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart.

UNIT- IV **(12 Hrs.)**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties-.Compressibility factor-.Principle of Corresponding states. - Generalised Compressibility Chart and its use.

UNIT- V **(12 Hrs.)**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function

Reference Books/Links:

1. Cengel. Y and M.Boles, "Thermodynamics – An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010.
2. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd, 2006.
4. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010.
5. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.

BVBPT125: Fermenter Design-I

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To understand process and measurement techniques in fermenter.
- To understand the basic design of fermenter and its operation

COURSE OUTCOMES:

- 1. The students will be able to understand design and working of fermenter.

Course Contents:

UNIT-I **(12 Hrs.)**

Design of bioreactors (Fermenter): Basic objective of fermenter design, aseptic operation & containment, body construction, agitator and sparger design, baffles, stirrer glands and bearings.

UNIT-II **(12 Hrs.)**

Process parameters and measurement techniques: measurement of temperature, pressure and pH, DO, foam etc.; flow rate of liquid and gases.

UNIT-III **(12 Hrs.)**

Automation (processes computerization). Validation of Fermentor. Bioreactor configurations and types: Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed.

UNIT-IV **(12 Hrs.)**

Membrane reactor, Photobioreactor, Solid state fermenter, Animal and plant cell bioreactors. Scale up and Scale down studies of bioreactors.

UNIT- V **(12 Hrs.)**

Heat and Mass transfer in Bioprocess, Relationship in between heat transfer, cell concentrations and stirring conditions, Measurement of KLa, Rheological properties of fermentation broths, Factors affecting broth viscosity, Mixing in Fermenters.

Reference Books/Link:

1. Principles of fermentation technology P.F. Stanburry & Whitaker Pergamon Press, II Ed, Butterworth Heinemann-Elsevier, 2005.
2. Bioprocess Engineering, Basic Concepts, II Ed. Michael L Shuler, FikretKargi, Prentice Hall of India pvt. Ltd. 2002.
3. Pauline M. Doran, Bioprocess Engineering Principles, Academic Press an Imprint of Elsevier.

BVBPT126: LAB: Based on Industrial media and energy balance

Credit: 3 **Marks: 50**

Practical based on Industrial media and energy balance:

1. Screening and Isolation of industrially important Microorganisms (such as Enzymes, and Organic acid Producing)
2. Screening and Isolation of Antibiotic producers.
3. Inoculum preparation for industrial production of Glutamic acid.
4. Inoculum preparation for industrial production of Alcohol.
5. Preparation of various Fermentation media for industrial production of Glutamic acid and Penicillin.
6. Media optimization for industrial production of Lactic acid.
7. Media optimization for industrial production of Alcohol

BVBPT127: LAB: Based on Operation of fermentation process

Credit: 3 **Marks: 50**

List of Practical based on Operation of fermentation process

1. Basic design of a laboratory fermenter.
2. Cleaning and sterilization of fermenter vessel.
3. Determination growth curve in a batch culture.
4. Production of Ethanol by simple/complex carbohydrate sources (media) using *Saccharomyces cerevisiae.*
5. Production of wine from apple / grape juice by *Saccharomyces cerevisiae.*
6. Production of citric acid by solid-state-fermentation using *Aspergillus niger.*
7. Production of Fungal alpha amylase by solid state fermentation

BVBPT128: Applied Microbiology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Knowledge on the understanding of the concepts and fundamental principles of microbiology; key features of the structure, growth, physiology and behaviour of bacteria, viruses, fungi and protozoa.
- Basic knowledge to deal with the study of genetic, metabolic strategies and ecology of microorganisms.
- Basic knowledge of the main microbiological techniques to be applied in the laboratory

COURSE OUTCOMES:

- The students will be able to select and use appropriate laboratory media for microorganism of interest in a safe and responsible manner.
- The students will be able to grow, identify & count microorganisms.
- Understand the role microorganisms in various fields

Course Contents:

UNIT-I **(12 Hrs.)**

Bacterial Nutrition- Major and minor nutrients. Construction of culture media for bacteria, fungi and actinomycetes. Classification of microorganisms.

UNIT-II **(12 Hrs.)**

Isolation of Bacteria by pour plate, spread plate and streak plate technique. Pure culture techniques. Preservation of culture. Biochemical Tests, sugar fermentation tests etc.

UNIT-III **(12 Hrs.)**

Effect of temperature, pH, Oxygen on microbial growth. Control of microbial growth. Various physical and chemical agents used to control microbial growth.

UNIT-IV **(12 Hrs.)**

Antimicrobial compounds, Antifungal antibiotics, antiviral compounds.

UNIT-V **(12 Hrs.)**

Antibiotics affecting cell wall, cell membrane protein synthesis.

Reference Books/Link:

1. General Microbiology Stanier, Ingraham and Painter.
2. Environmental Microbiology Maier, Pepper and Garba.
3. Text Book of Microbiology Ananth Narayan & Panikar

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BVBPT231: Energy and Environment

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To develop basic idea of energy resources allied techniques and conscience for environment among students

COURSE OUTCOMES:

On completion of the course, students should be able to —

1. Describe basic concepts of conventional and non-conventional energy
2. Recognize elements of primary non-conventional energy resources
3. Correlate pollution, role of human being, and threats to environment
4. Discuss ethical and legislative issues related to environment
5. Express the needs and basic routes towards environment sustainability

Course Contents:

UNIT-I: Fundamentals of Energy **(12 Hrs.)**

Global energy consumption profile, Oil crisis of 1973, Classification of energy resources, Consumption trends of primary energy resources, Importance of non-conventional energy resources, Energy chain, Common forms of energy,

Advantages and disadvantages of conventional energy resources, Salient features of on-conventional energy resources, environmental aspects of energy, Sustainable development, Energy density of fuels

Principles of energy conservation, Energy conservation ACT 2001, General electrical ECOs, Cogeneration, Need of energy storage, Overview of energy storage methods

UNIT-II: Non-conventional Energy Sources **(12 Hrs.)**

Solar energy basics, solar thermal systems, Basics of solar photovoltaic; WindEnergy fundamentals, Environmental aspects of wind energy generation, Biomass energy, Usable form of biomass- composition and fuel property, Biomass resources and conversion technologies, Urban waste to energy conversion, Biogas production from waste biomass.

Small Hydro resources, advantages and disadvantage, Layout, Water Turbines, Generation, Basics of financial and economic evaluation.

UNIT-III: Environment Pollution and Waste Management **(12 Hrs.)**

Pollution- Air, Water, Noise and Soil Pollution (causes, Effect, Control Measures); Nuclear hazards, Role of an individual in preventing pollution, Climate Change, Global Warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents; Disaster management.

Waste Management — Solid Waste Management, Causes, Effects and control measures of Urban and Individual waste, Municipal Solid Waste, Vermicomposting, Hazardous waste.

UNIT-IV: Social Issues and Environment **(12 Hrs.)**

Human Population — Population growth, Global profile, Urbanization, Environmental and Human health, Values and Human rights. Sustainable development, Waste conservation, Wasteland reclamation, Consumerism and waste products, Environmental Ethics- Issues and possible solutions

UNIT-V: Environment Regulations **(12 Hrs.)**

Environmental Acts - Environment Protection, Air (Prevention and Control of Pollution Act), Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environment legislation, Public Awareness. Environment Management Standards — ISO 14000, BHARAT and EURO Stages, Environmental Clearance/ Permission for establishing Industries

Text:

1. Textbook for Environmental Studies-Erach Bharucha for University Grants Commission; University Press; 2004New Delhi, India
2. Environmental Management- N. K. Uberoi; Excel Books;2013 New Delhi India
3. Non-Conventional Energy Resources; B. H. Khan; 2006 Tata McGraw-Hill Education; India

References:

1. Environmental Science and Engineering- Glynn Henry J., Gary W. Heinke;2004.; Pearson Education, Inc, NY
2. Non-Conventional Energy Sources- G. D. Rai, 2006; Khanna Publishers, India

Web:

1. https://onlinecourses.nptel.ac.in/noc18_ ge09/preview
2. https://nptel.ac.in/courses/127106004/
3. https://nptel.ac.in/courses/122106030/

BVBPT232: Biostatistics

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Recognize the importance of data collection and its role in determining scope of inference.
- Demonstrate a solid understanding of interval estimation and hypothesis testing.
- Choose and apply appropriate statistical methods for analyzing one or two variables.
- Use technology to perform descriptive and inferential data analysis for one or two variables.
- Interpret statistical results correctly, effectively, and in context.

COURSE OUTCOMES:

At the successful conclusion of this course, students will be able to:

- Identify cases and variables in a dataset, and classify variables as categorical or quantitative.
- Recognize that data and knowledge of statistics allows you to investigate a wide variety of interesting phenomena.
- Distinguish between a sample and a population.

Course Contents:

UNIT-I **(12 Hrs.)**

Basic definitions, notations and applications. Sampling: Representative sample, Sample size, sampling techniques.

UNIT-II **(12 Hrs.)**

Types of data, methods of collection of primary and secondary data, Data presentation (Histogram, polygon, ogive curves and Pie diagram).

UNIT-III **(12 Hrs.)**

Measures of Central Tendency: Mean, Mode, Median. Measures of Variability: Standard deviation, standard error, Range, Mean deviation , Quartile deviation and coefficient of variation.

UNIT-IV **(12 Hrs.)**

Positive and negative correlation, calculation of correlation coefficient, regression, linear regression and regression equation.

UNIT-V **(12 Hrs.)**

Chi square test, t-test, F-test, Z-test.

Reference Books/Link:

1. Campbell R.C.- Statistics for Biologists, Cambridge University Press, Cambridge.
2. Ward Law A.C. (1985)- Practical statistics for Experimental Biologists.
3. Baily N.T.J- Statistical Methods in Biology, English University Press.
4. P.S.S. Sunderrao and J. Richards-An introduction to Biostatistics, Prentice Hall Pvt. Ltd. India

BVBPT233: Central Dogma

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Describe the Central Dogma of molecular biology
- Know the general functions of the three major types of RNA (mRNA, rRNA, tRNA).
- Describe the DNA sequence motifs and proteins required to initiate transcription.
- Predict the RNA transcribed from a DNA sequence identified as either the template strand or the coding strand.
- Use the genetic code to predict the protein amino acid sequence translated from an mRNA sequence.
- Describe the process of and key components required for translation.
- Predict the likely effects of mutations in DNA on protein amino acid sequence, structure and function
- Compare and contrast prokaryotic and eukaryotic transcription and translation

COURSE OUTCOMES:

- DNA is transcribed to RNA via complementary base pairing rules (but with U instead of T in the transcript)
- The RNA transcript, specifically mRNA, is then translated to an amino acid polypeptide
- Final folding and modifications of the polypeptide lead to functional proteins that actually do things in cells.

Course Contents:

UNIT- I **(12 Hrs.)**

Replication in Prokaryotes –*Escherichia coli* replication as role model, DNA polymerases, Eukaryotic DNA replication ,Replication of extra chromosomal material, plasmid replication –rolling circle replication

UNIT- II **(12 Hrs.)**

Prokaryotic transcription ,Transcription in *Escherichia coli* a role model for prokaryotes Eukaryotic transcription , RNA polymerases Pol I, Pol II and Pol III –structural components and their roles ,Transcription initiation, Transcription elongation ,Transcription termination

UNIT- III **(12 Hrs.)**

Prokaryotic translation – translation initiation, ribosome assembly, initiation complex, Translation elongation, transpeptidation and chain elongation. Translation termination factors and release of ribosomes.

UNIT- IV **(12 Hrs.)**

Eukaryotic translation, Translation elongation comparative studies of elongation with *E. coli*. Translation termination factors, release of ribosomes and recycling, regulation

UNIT- V **(12 Hrs.)**

Excision repair, SOS repair, Mismatch repair, Photo reactivation

Reference Books/Links:

1. Molecular Biology –David Frifelder

2. Genes IX –Benjamin Lewin

BVBPT234: Fermenter Design-II

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objectives of the course are learning Basics of working mechanism and components of fermenter.

COURSE OUTCOMES:

- On completion of the course, students should be able to handle and maintain fermenter.

Course Contents:

UNIT-I **(12 Hrs.)**

Sterilization of fermenter, sterilization of air supply, Sterilization of exhaust gas from a fermenter.

UNIT-II **(12 Hrs.)**

Addition of inoculums, Addition of nutrients, Addition of supplements, Sampling, Feed ports, Sensor probes, Foam control, Monitoring and control of various parameters.

UNIT-III **(12 Hrs.)**

Gate valves, Globe valves, Piston valves, Needle valves, Plug valves, Ball valves , Butterfly valves , Pinch valves , Diaphragm valves, Pressure control valves, Steam traps

UNIT-IV **(12 Hrs.)**

Tower fermenter , Airlift fermenter , Stirred tank fermenter

UNIT-V **(12 Hrs.)**

Components of a computer –linked system Data Logging, Data analysis, Process control

Reference Books/Links:

1. Principles of Fermentation Technology – P. F. Stanbury, A. Whitaker

2. A textbook of industrial microbiology- Wulf Crueger and Anneliese Crueger

BVBPT235: Fundamentals of food technology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality and post harvest changes of various plant foods.
- To study the structure and composition of various animal foods

COURSE OUTCOMES:

- On completion of the course, students should be able to understand the biochemical compositional and nutritional aspects of plant and animal foods.

Course Contents:

UNIT-I **(12 Hrs.)**

Historical evolution of food processing technology, Structure and composition of cereals, Wheat-structure and composition, types (hard, soft/ strong, weak) Diagrammatic representation of longitudinal structure of wheat grains, Malting, gelatinization of starch, types of browning-Maillard & caramelization, Rice- structure and composition, parboiling of rice- advantages and disadvantages.

UNIT-II **(12 Hrs.)**

Structure and composition of pulses, toxic constituents in pulses, processing of pulsessoaking, germination, decortications, cooking and fermentation, Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids, Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, hydrogenation, Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

UNIT-III **(12 Hrs.)**

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

UNIT-IV **(12 Hrs.)**

Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat, Fish - Classification of fish (fresh water and marine), aquaculture , composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical, Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layer

UNIT-V **(12 Hrs.)**

Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

Reference Books/Links:

1. Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013
2. Roday,S. Food Science, Oxford publication, 2011.
3. B. Srilakshmi, Food science, New Age Publishers,2002
4. Meyer, Food Chemistry, New Age,2004

BVBPT236: LAB: Based on Fermenter Design-II

Credit: 3 **Marks: 50**

List of Practical based on Fermenter Design-II:

1. Determination of Thermal Death Point (TDP) microorganisms for design of a sterilizer
2. Determination of Thermal Death Time (TDT) microorganisms for design of a sterilizer.
3. Monitoring of dissolved oxygen during aerobic fermentation.
4. Study of bacteria and fungi in relation to their optimum growth conditions
   - pH
   - Temperature
   - Media comp

BVBPT237: LAB: Based on Fundamentals of food technology

Credit: 3 **Marks: 50**

List of Practical based on fundamentals of food technology:

1. Study different types of browning reactions: enzymatic and non enzymatic.
2. To study gelatinization behavior of various starches
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.
7. Quality inspection of animal foods.

BVBPT238: Upstream Process

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Discuss strategies for media selection and the impact this has on the performance of your upstream process.
- Examine process design considerations and development phases to develop an efficient upstream bioprocess system
- Discuss best practices for upstream and downstream process integration to maximize biomanufacturing effectiveness
- Understand how best to manage the transfer of the process to a GMP facility
- Learn how to maintain quality throughout your upstream process.

COURSE OUTCOMES:

Student can able

- To maximize performance by examining key areas of upstream process such as cell line development and media selection.
- To preserve industrially important microorganisms.

Course Contents:

UNIT-I **(12 Hrs.)**

Substrates used as carbon sources- whey, animal fats, methanol, ethanol, alkanes, Substrates used as nitrogen sources- ammonium salts, urea, gaseous ammonia, yeast extracts, peptones, soy meal.

UNIT-II **(12 Hrs.)**

Isolation Methods- Using desired characteristics, Enrichment liquid culture, enrichment cultures using solidified media

UNIT-III **(12 Hrs.)**

Storage at reduced temperature, Storage on agar slopes, Dried cultures, Lyophilization

UNIT-IV **(12 Hrs.)**

The isolation of induced mutants, the isolation of resistant mutants, The isolation of revertant mutants, the improvement of industrially important microorganisms by modifying properties other than the yield of the product.

UNIT-V **(12 Hrs.)**

Fermenter systems, Stirring and mixing, Gas exchange and nutrient solutions, Fermentation Processes.

Reference Books/Links:

1. Principles of Fermentation Technology – P. F . Stanbury , A. Whitaker
2. A textbook of industrial microbiology- Wulf Crueger and Anneliese Crueger

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BVBPT241: Personality Development and Stress Management

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To enable the students to understand the necessity of a pleasant personality
- Equip students with stress handling practices
- Provide effective verbal and non-verbal communication skills to students
- Provide effective interview, group discussion and professional skills necessary for global job sector to students

COURSE OUTCOMES:

On completion of the course, students should be able to

- Recognize self-management and interpersonal management skills
- Identify habits leading to stress
- Implement effective verbal and non-verbal communication skills in professional and personal realm
- Apply appropriate interview and group discussion skills

Course Contents:

UNIT- I: Changed Approach to Learning **(12 Hrs.)**

Introduction, Planning and Goal Setting Understanding People, Self- Management Skills, Developing Potential and Self Actualisation, Need Achievement, Conflict Resolution Skills Seeking Win-Win Situation, Interpersonal Conflicts, Types of Conflict, Conflict Resolution

UNIT- II: Stress and Habits **(12 Hrs.)**

Introduction, Types of Stress - Self-awareness about stress, Regulating Stress- Making the best out of stress, Stress Coping strategies, Habits-Guiding Principles, Identifying Good and Bad Habits, Habit Cycle, Breaking Bad Habits, Zeigernik effect for productivity and personal growth, Forming habit of success,

UNIT- III: Effective Communication **(12 Hrs.)**

Introduction, Barriers to communication - Arising out of sender's/ Receiver personality, Interpersonal Transactions, Miscommunication; Non-Verbal Communication-Introduction and Importance, Issues and Types, Basics and Universals, Interpreting Non-Verbal Cues

UNIT- IV: Becoming a Professional. **(12 Hrs.)**

Importance of Body Language, Body language For Interview, For Group Discussions; Presentation skills for a professional, Role of Body language during presentation, Using of visuals presentation, Effective Reading, Developing Trust and Integrity

UNIT- V: Tutorials, assignments and presentation based on Unit I to IV(12 Hrs.)

Reference Books/Links:

1 Personality Development and Soft Skills- BarunMitra, Oxford University Press;2012, ISBN 9780198066217

2. Personality Development and Soft Skills, Preparing for Tomorrow-S. Kapoor,Willey India; 2016, ISBN: 9789389583090

3. Effective Communication Skills- Dr M Sinha, Avishkar Publishers, ISBN: 9788179103500

4. MTD Training Effective Communication Skills; MTD Training Publishing APS, ISBN: 978-87-7681-598-1

5. Managing Stress- Ann Edworthy, Open University Press, SBN 0335204058

6. Stress Management-P. K.Dutta,Himalaya Publishing House Pvt.Ltd. ISBN: 978 81-8488-607

BVBPT242: Recombinant DNA Technology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To familiarize the student with emerging field of biotechnology i.e. Recombinant DNA Technology as well as to create understanding and expertise in wet lab techniques in genetic engineering.

COURSE OUTCOMES:

- At the end of the course, the students will have sufficient scientific understanding of the subject and have good knowledge of application of Recombinant DNA techniques in Life Sciences Research.

Course Contents:

Unit —I **(12 Hrs.)**

Enzymes used in DNA cutting and modification- Restriction endonucleases, DNA ligases, Exonucleases, Polymerases, Polynuclotide kinase.

Unit —II **(12 Hrs.)**

Plasmid cloning vectors, pBR322, pUC series of vectors, Lambda vectors- Insertion and replacement vectors , YAC, BAC, Shuttle vectors, Cosmids M13 vectors

Unit —III **(12 Hrs.)**

Shotgun cloning, Generalized strategy of obtaining cDNA from mRNA, construction of genomic library, DNA sequencing by chemical method, by enzymatic method and Chemical synthesis of DNA.

Unit —IV **(12 Hrs.)**

Nucleic Acid Purification methods, Radio labeling of Nucleic acids. Principle, method and applications of Southern and Northern Hybridization

Unit —V **(12 Hrs.)**

Polymerase Chain Reaction- Essential features , principle, methodology and applications of conventional PCR, RT-PCR. Applications of r DNA technology – in understanding genes & genomes, in biotechnology (protein production & protein engineering), in medicine & forensics, transgenic plants & animals

Reference Books/Links:

1. Recombinant DNA 2nd Edition. Watson, James D. and Gilman, M. (2001) W.H Freeman and Company, New York.
2. Molecular Biotechnology: Principles Application of Recombinant DNA 2 nd Edition. Glick, B. R. and Pasternak, J. J. (1998) ASM press Washington DC.
3. Genetic Engineering. Ahluwalia, K. B. (2002) New Age International (P) Ltd.

BVBPT243: Enzyme Technology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objective of the course provides the theory and knowledge relevant to the enzymology principles including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics.

COURSE OUTCOMES:

After completion students able to

- describe the biosynthesis and enzymatic degradation of biomass carbohydrates important in industrial processes and products,
- describe lignin structure, biosynthesis, and enzymatic degradation,
- explain the key structural and energetic factors which give rise to increased enzyme stability important for industrial application,
- summarize current processes involved in industrial enzyme production, from protein production to purification and formulation,
- describe methods for selection and optimization of industrial enzymes using genetic and biochemical techniques,

Course Contents:

UNIT-I **(12 Hrs.)**

Definition and importance of enzymes, Classification of enzymes, types of enzymes Monomeric, Oligomeric enzymes

UNIT-II **(12 Hrs.)**

Hypothesis of enzyme action- Lock and key, Induced fit hypothesis, Concept of activation energy, active site of an enzyme, Enzyme specificity

UNIT-III **(12 Hrs.)**

Sources of enzymes, Extraction of soluble and membrane bound enzymes, Methods of enzyme immobilization, Properties and applications of immobilized enzymes.

UNIT-IV **(12 Hrs.)**

Kinetics of single substrate enzyme catalyzed reactions, MM and LB curve. Enzyme inhibitors, reversible and irreversible, competitive, uncompetitive and non competitive inhibitions with suitable examples. Allosteric enzymes

UNIT-V **(12 Hrs.)**

Uses of enzymes in food and beverages , textile industries, leather industries and detergents. Enzymes in clinical diagnosis and therapeutic applications.

Reference Book/Link:

1. Enzymes – Biochemistry, Biotechnology, Clinical chemistry, 2004 by Trevor Palmer, East – West Press Edition.
2. Enzymes by Dixon and Web. Acad. Press.Laboratory manual in Biochemistry by J. Jayaraman. 2006, New Age International.

BVBPT244: Fermentation process and control

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objectives of the course to understand the development and control process of fermenter.

COURSE OUTCOMES:

- On completion of the course, students should be able to smoothly handle the fermentation process.

Course Contents:

UNIT -I **(12 Hrs.)**

Brief history of fermentation; Fermentation- general concepts, Applications of fermentation, Range of fermentation process- Microbial biomass.

UNIT -II **(12 Hrs.)**

Range of fermentation process- enzymes, metabolites, recombinant products, transformation process; Component parts of a fermentation process.

UNIT -III **(12 Hrs.)**

Process development, Optimization of a process, Classical and statistical methods of optimization, Immobilization: different matrices, whole cell and enzyme immobilization.

UNIT -IV **(12 Hrs.)**

General concept of a fermenter- Batch, fed-batch and continuous fermentation

UNIT – V **(12 Hrs.)**

pH control, Oxygen requirement and oxygen supply, Oxygen transfer kinetics; Determination of KLa value, Foam and antifoams, their effect on oxygen transfer

Reference Book/Link:

1. Stanbury, P. F., Whitaker and Hall, A. S. J., Principles of Fermentation Technology. Butterworth-Heinemann
2. Shuler, M.L. and Karg, I F., Bioprocess Engineering Basic Concepts, Prentice Hall.
3. Vogel, H.C. Todaro, C.L. and Todaro C.C., Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, Noyes Data Corporation/ Noyes Publications.

BVBPT245: Downstream Process

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objective of this course is to enable students to acquire knowledge on reaction engineering systems with emphasis on bioreactor design, operation and analysis of kinetics in biochemical engineering reactions along with separation and purification of desired products.

COURSE OUTCOMES:

Students will be able to:

- Perform bioreactor operations as applicable in bioprocess industries.
- Scale-up, simulate and model bioprocess operation
- Carry out separation and purification of fermentation products
-

Course Contents:

UNIT - I **(12 Hrs.)**

Overview of bio separation. Recovery of intracellular products: Cell disruption methods – physical methods (osmotic shock, grinding with abrasives, solid shear, liquid shear)

UNIT -II **(12 Hrs.)**

Chemical methods (alkali, detergents) – enzymatic methods

UNIT-III **(12 Hrs.)**

Separation of cells and other insolubles from fermented broth – sedimentation, filtration (pretreatment, filtration theory, continuous rotary filters)

UNIT- IV **(12 Hrs.)**

Microfiltration, Centrifugation (batch, continuous and basket).

UNIT- V **(12 Hrs.)**

Isolation and purification: precipitation, leaching, adsorption and ultrafiltration. Precipitation (ammonium sulphate, organic solvents, high MW polymers).

Reference Book/Link:

1. Bioseparations: Downstream processing for biotechnology. P.A.Belter, E.L.Cussler, WS.Hu. Wiley-Interscience. (1988).

2. Bioseparation science and engineering. Harrison et al. 2006. Oxford Univ. Press.

BVBPT246: LAB: Based on Biomass

Credit: 3 **Marks: 50**

List of Practical based on Biomass:

1. Extraction of biomass from different resources
2. Production of energy from plant material.
3. Production of energy from Animal materials
4. Production of ethanol from seed oil.
5. Production of energy from biodegradable materials.

BVBPT247: LAB: Based on RDT & Enzyme Technology

Credit: 3 **Marks: 50**

List of Practical based on RDT & Enzyme Technology

1. Detection of enzyme production by bacteria & Fungi: Proteases, alpha amylase, lipase, Cellulase.
2. Production of bacterial / fungal – alpha amylase.
3. Partial purification of – amylase by salt precipitation method.
4. Assay of alpha amylase in terms of reducing sugar produced & calculation of enzyme unit.
5. Extraction of papain from papaya leaves. Estimation of its activity in terms of Ammonia.
6. Isolation of plasmid DNA
7. Study of restriction fragments of –DNA
8. Isolation of genomic DNA from bacterial cell.
9. PCR amplification of isolated bacterial genomic DNA using universal primers
10. Extraction and purification of amplified DNA fragment from gel.

BVBPT248: Plant Breeding

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objectives of the course to examine principles of plant breeding in self- and cross-pollinated crops. Additional topics include crop domestication, mating systems, heritability, gain from selection, disease resistance, polyploidy, marker assisted selection and government regulations.

COURSE OUTCOMES:

- Identify sources of genetic variation to conduct a breeding program
- Identify characteristics of self- and cross-pollinated plants
- Determine breeding methodology appropriate for plants with different mating systems
- Conduct basic statistical analyses related to plant breeding
- Analyze journal articles related to cultivar development
- Conduct and analyze a selection experiment
- Communicate background information and original ideas related to breeding a specific crop

Course Contents:

UNIT-I **(12 Hrs.)**

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding.

UNIT-II **(12 Hrs.)**

Patterns of Evolution in Crop Plants- Centres of Origin-biodiversity and its significance. Genetic basis of breeding self- and cross - pollinated crops including mating systems and response to selection - nature of variability, components of variation.

UNIT-III **(12 Hrs.)**

Heritability and genetic advance, genotype-environment interaction; General and specific are combining ability.

UNIT-IV **(12 Hrs.)**

Types of gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding

UNIT-V **(12 Hrs.)**

Special breeding techniques- Mutation breeding; Breeding for abiotic and biotic stresses.

Reference Books/Links:

1. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.
2. Chopra VL. 2004. Plant Breeding. Oxford & IBH.
3. Gupta SK. 2005. Practical Plant Breeding. Agribios.
4. Pohlman JM & Bothakur DN. 1972. Breeding Asian Field Crops. Oxford & IBH.
5. Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publ. House.

B.Voc.
(Bioproducts Technician)
Third Year
Semester-V

BVBPT351: Human Resource Management

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

The aim of the Human Resource Management (HRM) is to give students the knowledge, understanding and key skills that are required by today's HR professionals and to enable students to effectively contribute to dynamic organizations.

COURSE OUTCOMES:

1: Explain the importance of human resources and their effective management in organizations
2: Demonstrate a basic understanding of different tools used in forecasting and planning human resource needs.
3: Describe the terminologies and tools used in managing employees effectively.
4: Describe rules and regulations affecting employees and employers.

Course Contents:

Unit –I **(12 Hrs.)**

Introduction to Human Resource Management - Concept, Nature, Scope, Significance, Objectives and Functions of HRM.

Unit-II **(12 Hrs.)**

— Human Resource Planning (HRP) - Meaning and need for Human resource Planning - Process of HRP - Factors affecting HRP, —Job Analysis -Recruitment and selection — Meaning, - Sources of recruitment.

Unit-III **(12 Hrs.)**

Employee Training - Meaning and need for training - Steps in training - Methods of Training — Impediments of effective training

Unit- IV **(12 Hrs.)**

Performance Appraisal and Merit Rating - Meaning and purpose of performance appraisal - Methods of performance appraisal - Ethics in performance appraisal — Merit Rating — Meaning, Benefits of Merit Rating — Difference between performance appraisal and merit rating.

Reference Books/Links:

1.Principles of Personnel Management — by Edwin B Phlipo
2. Management of Organization Behaviour — by Paul Harsey K. Blanchard
3. Personnel/Human Resource Management — Decenza& David
4. Human Resource Management- P.Subbarao
5. Human Resource Management: R.S.Triwedi
6. K Ashwathappa : Human Resource Management, Tata McGraw Hill, New Delhi

BVBPT352: Growth Energetic

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objective of this paper is to understand concepts of Microbial growth and different aspects regarding growth kinetics.

COURSE OUTCOMES:

- Students enable to better understand the energetic of microbial growth.

Course Contents:

UNIT- I **(12 Hrs.)**

Thermodynamics principles, Microbial Growth, phases of batch growth, Types of microbial growth curve.

UNIT- II **(12 Hrs.)**

Mathematical expression of microbial growth, The Monod and Pirt models for microbial growth.

UNIT- III **(12 Hrs.)**

Growth in Bioreactors Continuous bioreactors and bioreactor performance, Chemostat as a Batch Bioreactor.

UNIT -IV **(12 Hrs.)**

Monod kinetics, Volumetric rates, specific rates and yields, Energetics and Stoichiometry of Growth and Maintenance

UNIT -V **(12 Hrs.)**

Kinetics of Suspended-Growth Biological Processes, Rates, Kinetic Coefficients, System Control Parameters.

Reference Books/Links:

1. Principles of fermentation technology (second edition)- P. F. Stanbury, A. Whitaker, and S. J. Hall
2. Brock Biology of Microorganisms Madigan, M.T., Bender K.S. Buckley D.H., Sattley W.M. and Stahl D.A
3. Microbiology an introduction Tortora et al. 2008., Pearson Education

Elective (a)

BVBPT353: Animal Cell Culture Technology & Transgenic Animal

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To understand the basic concept of animal cell culture
- To learn aseptic techniques involved in handling of animal cell culture
- To understand the types and environment of cell culture
- To understand the strategies for the production of transgenic animals and their importance in biotechnology and stem cell cultures in the production of transgenic animals.

COURSE OUTCOMES:

- Students will learn to demonstrate foundational knowledge of Cell culture techniques and competence in laboratory techniques.
- Students are taught to have in-depth knowledge of stem cells and its uses, clinical use of stem cell therapy in clinical use.

Course Contents:

UNIT- I **(12 Hrs.)**

Introduction to animal cell culture technology, its applications, and equipments used in tissue culture lab, Basic tissue culture techniques culturing of cells, adherent cells and suspension cells.

UNIT- II **(12 Hrs.)**

Basic tissue culture techniques common cell lines, aseptic methods, Animal cell cultures Primary and secondary cell lines cell culture environment, Safety measures laminar hood, Maintenance and preservation of cell cultures freezing media

UNIT- III **(12 Hrs.)**

Various types of cultures Bioreactors, suspension cultures, continuous flow cultures, Immobilized cultures; somatic cell fusion using PEG, Cell cultures as a source of valuable products.

UNIT- IV **(12 Hrs.)**

Concepts of transgenic animal technology & Strategies for the production of transgenic animals, what is transgenesis, procedure for transgenesis, DNA microinjection, Embryonic stem cellmediated gene transfer, Retrovirus-mediated gene transfer.

UNIT- V **(12 Hrs.)**

Stem cell cultures in the production of transgenic animals.- mice, stem cell therapy for tissue replacement and their clinical use.

Reference Books:

1. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press.
2. R.Ian Freshney Culture of Animal ceas, A Manual of basic technique 4th Edition
3. Ranga M.M. Animal Biotechnology. Agrobios India Limited.
4. Ramadass P, Meera Rani S. Text Book of Animal Biotechnology

Elective (b)

BVBPT353: Post production cleaning & maintenance

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The objective of this paper is to enable the student to acquire the knowledge of postproduction cleaning and maintenance of lab and laboratory equipments

COURSE OUTCOMES:

- A student becomes able to clean and maintain lab and laboratory equipment after post production.

Course Contents:

UNIT- I **(12 Hrs.)**

Describe the steps involved in the routine maintenance of tools and equipment in laboratories as per schedules.

UNIT- II **(12 Hrs.)**

Identify faults, losses, defects, wear or breakage in the tools and equipment, explain various labelling methods used in the industry

UNIT- III **(12 Hrs.)**

Perform labelling of faulty and damage tools and equipment in laboratory

UNIT- IV **(12 Hrs.)**

Perform recalibration of tools and equipment, Perform minor repairs of tools and equipment in laboratory

UNIT- V **(12 Hrs.)**

Perform cleaning, lubrication and servicing of tools and equipment in laboratory, describe the process of storage of tools and equipment after completion of work.

Reference Books:

1. The Laboratory Companion: A Practical Guide to Materials, Equipment, and Technique by Gary S. Coyne

Elective (a)

BVBPT354: Bioprocess Monitor & Control

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To understand the fundamentals of process control as applied to bioprocesses in the industry.

COURSE OUTCOMES:

- Student enable to observe small changes in a process can have a large impact on the end result.
- Student enable to understand the variations in proportions, temperature, flow, and many other factors must be carefully and consistently controlled to produce the desired end product with a minimum of raw materials and energy.

UNIT – I **(12 Hrs.)**

Pressure measurement, pressure control, safety valves, measurement and control of dissolved oxygen; flow measurement and control

UNIT – II **(12 Hrs.)**

In line – On-line data analysis for measurement of important physico-chemical and biochemical parameters; online sensors foe cell properties; off line analytical methods; computer control of fermentation process

UNIT – III **(12 Hrs.)**

Introduction to biosensors; Transduction principles used in biosensors; Characteristics of biosensors; Biosensors based on amperometric, potentiometric, fiber optics and bioluminescence; Microbial biosensors

UNIT – IV **(12 Hrs.)**

Manual control; automatic control – two – position controllers (on/ off), proportional control, integral control, derivative control

UNIT – V **(12 Hrs.)**

Combination of methods of control- proportional plus integral control (PI), proportional plus derivative control (PD); proportional plus integral plus derivative control (PID).

Reference Books:

1. Principles of fermentation technology (second edition)- P. F. Stanbury, A. Whitaker, and S. J. Hall
2. Biochemical Engineering Fundamentals, JE Bailey, DF Ollis, 1986.
3. Bioprocess Engineering: Basic Concepts, 2nd Edition. ML Shuler and F Kargi, 2002.
4. Bioprocess Engineering Principles, PM Doran, 1995.
5. Sensors in Bioprocess Control (Biotechnology and Bioprocessing Series) by John Twork

Elective (b)

BVBPT354: Neutraceuticals

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To understand the concept of functional foods, nutraceuticals and natural health products.
- It familiarizes students with examples of bioactive ingredient-disease relationships and the importance of clinical study support.
- To understand regulatory aspects of functional foods; and requirements for standards of evidence of efficacy for health claims; and market determinants of the functional food industry.

COURSE OUTCOMES:

- Describe components of nutraceutical and functional foods
- Evaluate the standards of evidence required for efficacy and safety assessment of nutraceutical and functional foods
- Work effectively as a group member on a specific problem related to functional foods and nutraceutical products.

Course Contents:

UNIT-I **(12 Hrs.)**

Definition of the functional food, nutraceuticals, dietary supplements and natural health products with the focus on the India, US, Canada, Europe, and Japan , Criteria that discriminate between conventional and functional foods, Foods, health promotion and disease prevention, Market for functional foods and factors driving they growth, Challenges for marketers at the food-drug interface; market readiness, market barriers and distribution.

UNIT- II **(12 Hrs.)**

Examples of bioactive ingredients and metabolic basis for nutrient-disease relationships • Major chronic diseases and bioactives used for risk reduction.

UNIT- III **(12 Hrs.)**

Dietary fiber (soluble fiber, beta-glucan etc.) – sources, chemical structure, metabolic aspects and coronary heart disease (CHD), diabetes , Probiotic, Prebiotic - sources, efficacy and health benefits (e.g. gut health), safety, foods versus dietary supplements, Phytochemicals: plant sterols – commercial sources, efficacy, mechanism of action, heart health and other health benefits, safety, regulatory and commercial products.

UNIT- IV **(12 Hrs.)**

Other phytochemicals: carotenoids, flavonoids, tea catechins – metabolic aspects, CHD and risk reduction of other disease, Functional lipids – long chain polyunsaturated fatty acids (e.g. omega-3), medium chain triglycerides, structured lipids, conjugated linolenic acid, metabolic aspects, obesity.

UNIT- V **(12 Hrs.)**

Safety concerns for active ingredients, Interaction with food constituents, Effect of processing, Dietary Exposure, Safety assessment: nutritional and toxicological, Efficacy assessment and importance of efficacy evidence.

Reference Books

1. Saarela M. 2011. Functional Foods: Concept to Product. 2nd edition. Oxford, Cambridge. Woodhead Publishing Ltd
2. Bagchi D. 2014. Nutraceuticals and Functional Foods Regulations in the United States and Around the World 2nd edition. Elsevier.
3. Schmidl MK and Labuza TP. 2000. Essentials of Functional Foods, Functional Foods and Nutraceutical series. Technomic Publishing Co., Inc.
4. Zawistowski J. 2010. Tangible Health Benefits of Phytosterol Functional Foods. J. Smith and E. Charter (Eds) In: Functional Food Product Development. WileyBlackwell.
5. Zawistowski J and Kitts DD. 2004. Functional Foods – A New Step in the Evolution of Food Development. Clinical Nutrition Rounds. 4:1-6.

BVBPT355: Practicals based on Neutraceuticals

Credit: 3 **Marks: 50**

1. Extraction of plant secondary metabolites by different methods.
2. Chemical profiling of plant samples and extracts.
3. Isolation and purification of colours and flavours from plant sources/ TLC separation of Plant pigments – Curcumin and carotene.
4. Estimation of ascorbic acid from lemon & amla juice by titration method.
5. Estimation of preservatives and antioxidants from food sample.
6. Quantification of proteins by Folins cio-calteau method.
7. Lab scale preparation of fermented milk products.
8. Determination of caffeine and tannin content in coffee and tea.
9. Preparation of traditional health products – e.g. Satavari kalp, gulkand, Amla syrup, bilwa jam.

BVBPT356: Off campus Industrial /Institutional Training/Field survey (After end of IVth semester)

Credit: 6 **Marks: 175**

BVBPT357: Major Project –I

Credit: 3 **Marks: 100**

1. Review1: PRE-PRODUCTION	**20 Marks**
2. Review2: PRODUCTION	**20 Marks**
3. Review3: POST-PRODUCTION	20 **Marks**
1. University Examination	**40 Marks**
Presentation	15 Marks
Viva	15 Marks
Final Report	10 Marks

BVBPT358: Seminar

Credit: 1 **Marks: 25**

B.Voc.
(Bioproducts Technician)
Third Year
Semester-VI

BVBPT361: Entrepreneurship Development

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- To provide the students with basic traits of entrepreneurship
- To introduce students with entrepreneurial environment
- To equip students with basic tools for business plan preparation
- To equip students with concepts of launching and management of small business

COURSE OUTCOMES:

On Completion of the course, students should be able to -

- Explain key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities
- Describe Key concepts underpinning innovation and the issues associated with developing and sustaining innovation within organizations
- Plan creative strategies for pursuing, exploiting and developing new opportunities
- Analyse basic Issues associated with securing and managing new business ventures

Course Contents:

Unit- I: Entrepreneur **(12 Hrs.)**

Entrepreneurship concept, Entrepreneurship as a career, Required Personality traits for an entrepreneur, Characteristics of an Entrepreneur, Functions of an Entrepreneur, Entrepreneur vs. Manager, Entrepreneur/Corporate Entrepreneur

Unit- II: Entrepreneur Development **(12 Hrs.)**

Types of Entrepreneurs, Motivating Factors to Become Entrepreneur, Entrepreneurial Competencies, Requirements for Successful entrepreneur, Entrepreneur and Economic Development

Unit- III: Entrepreneurial Environment **(12 Hrs.)**

Business Environment, Role of Family and Society, Challenges, Entrepreneurship Development Training and Other Support Organizational Service, Start-up Accelerators, Students Standbox and Business Labs, Crowd Funding, Venture Capital, Co-Working Spaces, Boot Camps, Central and State Government Policies and Regulations

Unit- IV: Business Plan Preparation **(12 Hrs.)**

Sources of Product for Business, Pre-feasibility Study, Criteria for Selection of Product, Ownership, Capital, Budgeting Project Profile Preparation, Matching Entrepreneur with theProject, Feasibility Report Preparation and Evaluation Criteria

Unit- V: Launching and Management of Small Business **(12 Hrs.)**

Finance and Human Resource Mobilization Operations Planning, Market and ChannelSelection, Growth Strategies, Product Launching, Monitoring and Evaluation of Business,Preventing Sickness and Rehabilitation of Business Units, Effective Management of SmallBusiness

Text:

1. Entrepreneurship: R. D. Hisrich, M. P. Peters. D. A. Shepherd; McGraw Hill India; ISBN: 9789353163457
2. Entrepreneurship Development: E. Gordon, K. Natarajan; Himalaya Publishing House; ISBN: 9789352025404
3. Entrepreneurship Development: S. S. Khanka; S$. Chand and Company; ISBN: 8121918014

Suggested Reading:

1. Dynamics of Entrepreneurial Development and Management: V. Desai; Himalaya Publishing House; ISBN: 9788184884975
2. Entrepreneurial Development: N. P. Srinivasan & G.P. Gupta; S. Chand & Sons, ISBN 9788170148012

BVBPT362: Bioethics & IPR

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Creating awareness about broader global ethical issues in healthcare.
- Familiarizing students with the issue of religious diversity in healthcare, particularly at the end of life.
- Imparting knowledge and skills that will enable students to develop ethical answers to these issues.

COURSE OUTCOMES:

- Identify the historical forces that have contributed to the current global systems and these systems' consequences for humanity and/or the environment
- Explain how the theoretical approaches of the social sciences analyze and evaluate the impact of social class, race and/or gender on self and group identity and people's responses to diversity
- Research and write brief scholarly essays that present cogent argument(s), engage scholarly literature, and demonstrate critical thinking and analysis regarding global bioethics

Course Contents:

UNIT-I **(12 Hrs.)**

Bioethics: Legality, morality and ethics, the principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity, Ethical issues – ethical issues against the molecular technologies.

UNIT-II **(12 Hrs.)**

Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Legal issues – legal actions taken by countries for use of the molecular technologies.

UNIT-III **(12 Hrs.)**

Social issues -public opinions against the molecular technologies, Biosafety concepts and issues: Rational vs. subjective perceptions of risks and benefits, relationship between risk, hazard, exposure and safeguards, biotechnology and biosafety concerns at the level of individuals, institutions, society, region, country and the world.

UNIT-IV **(12 Hrs.)**

Biosafety in the laboratory institution: Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory/ institution

UNIT-V **(12 Hrs.)**

Intellectual Property Rights – Why IPR is necessary, TRIPS & IPR, IPR – national & international scenario, IPR protection of life forms.

Reference Books/Links:

1. IPR, Biosafety and Bioethics by Deepa Goel & Parashar
2. A Textbook of Bioethics for Healthcare Professionals by Princy Louis
3. Thomas, J.A., Fuch, R.L. (2002). Biotechnology and Safety Assessment (3rd Ed). Academic Press.
4. Fleming, D.A., Hunt, D.L., (2000). Biological safety Principles and practices (3rd Ed). ASM Press, Washington.

Elective (a)

BVBPT363: Supply chain & enterprise resource planning in Biomanufacturing

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Manage flow of materials in a supply chain
- Understand the design, planning and supply chain of bio-products

COURSE OUTCOMES:

- Students can able to understand supply chain, management of flow of materials.

Course Contents:

UNIT-I **(12 Hrs.)**

Introduction to biomanufacturing and its processes, Design of Experiments for Biomanufacturing

UNIT- II **(12 Hrs.)**

Design of Biomanufacturing Facilities, Critical Utilities, Processes and Equipment

UNIT- III **(12 Hrs.)**

The measurement, monitoring, modeling, and control of biomanufacturing processes, An examination of new technologies in biological production and purification operations

UNIT- IV **(12 Hrs.)**

Supply Chain and Enterprise Resource Planning, manage flow of materials in a supply chain Understand the design, planning and execution of raw material procurement and use

UNIT- V **(12 Hrs.)**

Eligibility for certification test, quality risk management, qualification, and validation, An examination of new regulatory requirements and changes to current practices in biomanufacturing quality

Reference Books/Links:

1. Enterprise Resource Planning and Supply Chain Management by Kurbel & Karl

Elective (b)

BVBPT363: Methods in quality improvement, investigations & Audits
Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Describe the history and background of Quality Improvement in health care and public health.
- Summarize the most commonly used Quality Improvement models
- Describe how accreditation, regulation and public reporting impact quality improvement

COURSE OUTCOMES:

- Students able to improve the quality of bioproducts, to investigate it with scientific methods as well as quality management system.

UNIT-I **(12 Hrs.)**

Defining Continuous Quality Improvement, Processes and Systems, the evolution of the quality movement, Variation – Quality Assurance vs. Quality Improvement – Accreditation and Regulation

UNIT-II **(12 Hrs.)**

Human Factors and Human Error – Supporting Human Behavior, The Quality Improvement tool box

UNIT-III **(12 Hrs.)**

Quality investigation, planning of system audit, system auditing, Preparation of statement on auditing procedure

UNIT-IV **(12 Hrs.)**

Record of audit result, System audit reporting: description of finding, description of recommended improvement.

UNIT-V **(12 Hrs.)**

Management of System Audit Tasks: Progress management, Quality management, Improvement of audit tasks, Enhancement of audit framework.

Reference Books/Links:

1. Langley, G.J., Moen, R., Nolan, K.M., Nolan, T.W., Norman C.L., & Provost, L.P. (2009). The improvement guide: A practical guide to enhancing organizational performance (2nd ed.). San Francisco, CA: Jossey-Bass.
2. Brassard, M., Ritter, D. (2007). The public health memory jogger II: A pocket guide of tools for continuous improvement and effective planning. F. Oddo (Ed.). Salem, NH: GOAL/QPC.

Elective (a)

BVBPT364: Documentation & Record keeping

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- The aims of this online Documentation and Record-Keeping paper are to improve bioproducts, health and social care workers' understanding of the legislative, regulatory and professional requirements for keeping medical/care records appropriately.

COURSE OUTCOMES:

- Explain why it is essential to maintain excellent clinical/medical records/ bioproducts records.
- Understand your responsibilities for maintaining good clinical records/ bioproducts records.
- Explain what constitutes clinical records in practice.
- Understand the legal requirements for record-keeping.
- Know how long clinical records should be kept.
- Understand how the Data Protection Act applies to your practice.

Course Contents:

UNIT- I **(12 Hrs.)**

Why are bioproducts records important, Concept of bioproducts records, adequate bioproducts records

UNIT- II **(12 Hrs.)**

Who can have access bioproducts records, charging for access to bioproducts records, what counts as bioproducts records?

UNIT- III **(12 Hrs.)**

How long should bioproducts records be kept, The Data Protection Act 1998

UNIT- IV **(12 Hrs.)**

Data protection principles, Data protection terminology

UNIT- V **(12 Hrs.)**

The Data Protection act 1998 rights of data subjects, Storage, security, and disposal of bioproducts records

Reference Books/Links:

1. Documentation for Health Records by Cheryl Gregg Fahrenholz

Elective (b)

BVBPT364: Bioremediation Technology

Credit: 4 **Marks: 100**

LEARNING OBJECTIVES:

- Demonstrate an understanding of the nature and importance of bioremediation.
- Define bioremediation and when each strategy would be most applicable.
- Understand the influence of site characteristics: hydraulic conductivity, soil type, microbial presence, and groundwater properties.
- Understand the influence of contaminant characteristics to bioremediation (e.g. chemical structure, toxicity, and solubility).
- Demonstrate the use of course concepts to solve problems in real world applications.

COURSE OUTCOMES:

- Students will learn the basics of microbiology, understand the topics, and be able to formulate biodegradation kinetics and remediate organic and inorganic compounds through case studies, laboratory demonstrations, and field studies.

UNIT-I **(12 Hrs.)**

Bioremediation, Current remediation practices, benefits of bioremediation, The soil environment; Fate and transport of contaminants in soils and water bodies.

UNIT-II **(12 Hrs.)**

Chemical transformations, Microbial ecology and metabolism

UNIT-III **(12 Hrs.)**

Biodegradation of common contaminant compounds

UNIT-IV **(12 Hrs.)**

In situ bioremediation strategies, Solid phase bioremediation

UNIT-V **(12 Hrs.)**

Slurry phase bioremediation, Vapour phase bioremediation

Reference Books/Links:

1. LaGrega, M., Buckingham, P., Evans, J. & The Environmental Resources Management Group. *Hazardous Waste Management.* USA: McGraw-Hill, 1994. ISBN:0-07-019552-8.
2. Bioremediation Principles. Eweis, Ergas, Chang, and Schroeder. WCB McGraw-Hill. ISBN 0-07-057732-3.

BVBPT365: Bioenergy production

Credit: 4 **Marks: 50**

LEARNING OBJECTIVES:

- To provide a thorough understanding of various renewable feedstocks of importance to Hawaii, their availability and attributes for biofuels production.
- To provide a thorough understanding of the broad concept of second and third generation biofuel production from biomass and other low-cost agri-residues and biowastes.
- To provide students with tools and knowledge necessary for biofuel facility operations.
- To teach our students to analyze and design processes for biofuel production.

COURSE OUTCOMES:

- Understanding of renewable feedstock and their availability
- Understanding of techniques for biofuel production
- Understanding of design process for biofuel production

Course Contents:

UNIT-I **(12 Hrs.)**

Current energy consumption, overview of biofuel/bioenergy and biorefinery concepts Fundamental concepts in understanding biofuel/bioenergy, Renewable feedstocks and their production

UNIT- II **(12 Hrs.)**

Feedstocks availability, characterization and attributes for biofuel/bioenergy production, Biomass preprocessing: drying, size reduction, and densification, Various biofuels/bioenergy from biomass

UNIT- III **(12 Hrs.)**

Biomass conversion to heat and power: thermal gasification of biomass, anaerobic digestion, Biomass conversion to biofuel: thermochemical conversion, syngas fermentation

UNIT- IV **(12 Hrs.)**

Biochemical conversion to ethanol: biomass pretreatment, Different enzymes, enzyme hydrolysis, and their applications in ethanol production, Biodiesel production from oil seeds, waste oils and algae.

UNIT- V **(12 Hrs.)**

Environmental impacts of biofuel production, Energy balance and life-cycle analysis of biofuel production, Value-added processing of biofuel residues and co-products.

Reference Books/Links:

1. Biorenewable Resources: Engineering New Products from Agriculture. Robert C. Brown. Wiley-Blackwell Publishing (2003).

2. Anaerobic Biotechnology for Bioenergy Production: Principles and Applications. Samir K. Khanal. Wiley-Blackwell Publishing (2008)

BVBPT366: Off campus Industrial /Institutional Training/Field survey (After end of Vth semester)

Credit: 4 **Marks: 100**

In-Plant Training – III (After end of Vth semester)

BVBPT367: Major Project –II, Report and Seminar

Credit: 6 **Marks: 200**

1. Review1: PRE-PRODUCTION	**40 Marks**
2. Review2: POST-PRODUCTION	40**Marks**
a) **University Examination**	**70 Marks**
Presentation	20 Marks
Viva	20 Marks
Final Report	30 Marks
Seminar	50 Marks