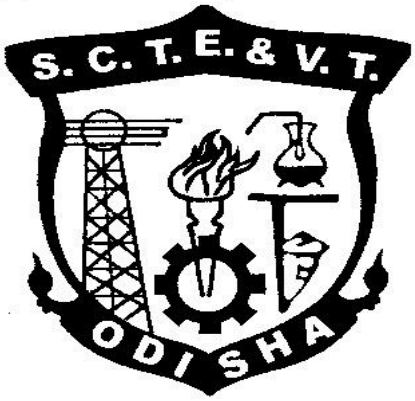
CURRICULLUM OF 6TH SEMESTER

For

DIPLOMA IN BIOTECHNOLOGY

(Effective from 2020-21 Sessions)



STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 6th Semester (Biotechnology)(wef 2020-21)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Plant Safety Management(C)	4	-	-	20	80	3	100
Th.2		Enzyme Engineering	4	-	-	20	80	3	100
Th.3		Bioprocess Engineering	4	-	-	20	80	3	100
Th.4		Elective Subject 1. Pharmaceutical Technology 2.Food technology 3. Vaccine biotechnology	4	-	-	20	80	3	100
		Total	*16*	-	-	*80*	*320*	-	*400*
		Practical							
Pr.1		Plant Safety Laboratory	-	-	3	25	25	3	50
Pr.2		Bioprocess Engineering Laboratory	-	-	6	50	50	3	100
Pr.3		Project Phase-II	-	-	9	75	100	3	175
Pr.4		Life Skills	-	-	2	25	-	-	25
		Student Centred Activities(SCA)	-	-	3	-	-	-	-
		Total	-	-	*23*	*175*	*175*	-	*350*
		Grand Total	**16**	**-**	**23**	**255**	**495**	**-**	**750**

Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM/Idea Tinkering and Innovation Lab Practice etc., Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

Th1. PLANT SAFETY MANAGEMENT

Common to Chemical, Biotechnology & Food Technology

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	6th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. **RATIONALE**:

The present day industrial environment demands increased production, high efficiency, control of cost, stringent quality control. The production processes have become complex and capital intensive. To meet such needs of industries, the subject of safety, health and environment (S,H and E) has attained significance importance. Today safety is an integral part of any industry. The engineers are therefore expected to have firsthand knowledge of this subject.

B. OBJECTIVES:

On completion of study of Plant Safety Management the student will be able to understand

1. Concept of safety management
2. Safe working practice
3. Use of Personal Protective Equipment
4. Fire Prevention & can do Fire Fighting.
5. Understand Chemical Hazards, Mechanical Hazards, Electrical Safety, Electrical Shocks

C. Topic Wise Distribution of Periods

SL. No.	Topics	Period
1	Introduction to Industrial safety management	08
2	Safe working practice	10
3	Personal Protective Equipment	08
4	Fire Prevention & Fire Fighting	08
5	Chemical Hazards	10
6	Electrical Safety, Electrical Shocks & their prevention	10
7	Mechanical Hazards	06
	Total	60

D. COURSE CONTENT

Chapter 1.0 INTRODUCTION TO INDUSTRIAL SAFETY MANAGEMENT

1.1 Fundamental of safety
1.2 Unsafe act and unsafe condition
1.3 Integration of Safety, Health and Environment
1.4 Objective and principle of Safety Management
1.5 Terms and definition used in safety management
1.6 Classification of accidents

Chapter 2.0 SAFE WORKING PRACTICE

2.1 Good Housekeeping practice
2.2 Work place safety
2.3 Safe working environment
2.4 Spot a hazard to stop an accident
2.4 Precaution in use of ladder
2.5 Safety instruction during maintenance
2.6 Safety measures during handling of compressed system, cylinders and painting Equipments
2.7 Permit to work system

Chapter 3.0 PERSONAL PROTECTIVE EQUIPMENTS (PPE)

3.1 Requirement of personal protective equipment
3.2 Classification of Hazards
3.3 Personal protective equipments for different parts of body
3.4 Guideline to use personal protective equipment

Chapter 4.0 FIRE PREVENTION AND FIRE FIGHTING

4.1 Fundamentals of fire, elements of fire.
4.2 Terms and definition in Fire Management.
4.3 Classification of fire and fire extinguishing technique
4.4 Causes of fire and its prevention
4.5 Different types of fire extinguisher and their application
4.6 Precaution for prevention of fire

Chapter 5.0 CHEMICAL HAZARDS

5.1 Classification of Chemical Hazards
5.2 Factors influencing effects of toxic chemicals
5.3 Terms related to concentration level as per industrial hygiene norm
5.4 Control measure for Chemical hazards

Chapter 6.0 ELECTRICAL SAFETY, ELECTRICAL SHOCK AND THEIR PREVENTION

6.1 Introduction to electrical safety
6.2 Precaution and safety in use of electricity
6.3 Electrical hazards in Industrial system
6.4 Safety provision to prevent electrical hazards

Chapter 7.0 MECHANICAL HAZARDS

7.1 Sources of mechanical hazards
7.2 Machine Guard and Safety devices
7.3 Pressure hazards and pressure vessel
7.4 Safety measures in use of gas cylinders
7.5 Types of maintenance (example- Breakdown, preventive)

Syllabus Coverage up to I.A
Chapter 1,2,3

E. Book Recommended			
Sl. no	Name of Author	Title of Book	Name of Publisher
1	R.K. Jain, Sunil Rao	Industrial safety Health and Environment System	Khanna Publication
2	Tarafdar & Tarafdar	Industrial Safety Management	Dhanpat Ray & Sons
3	Amit Gupta	Industrial, safety and Environment	Laxmi Publication

Th2. ENZYME ENGINEERING

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	6th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. RATIONALE:.

Enzyme catalysts are central to life. They are the vehicles for delivering innovative bioscience solutions to chemicals manufacture, drug discovery, therapeutics and bio processing. They are the key enablers in the white biotechnology revolution, providing essential components in the new science of 'synthetic biology', offering new routes to bio fuels, bulk and commodity chemicals and novel therapeutics.

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B. OBJECTIVES:

On completion of studies of Immunology & Enzyme Engineering the student will be able to
(i) Know about immune system and their role for the existence of life.
(ii) Know about the different types of immunological systems that occurs inside the body and helps to protect the organism from different diseases.
(iii) Know about the biology, structure and function of enzymes in different biochemical processes about the different application of enzymes in different fields of biology.

C. Topic Wise Distribution of Periods

Sl. No	TOPICS	Periods
1.	Enzyme and its Function	14
2.	Enzyme kinetics	14
3.	Enzyme inhibition and regulatory enzyme	14
4.	Production of Enzymes and synthesis of chemicals using Enzymes	10
5	Enzyme immobilization	08
	TOTAL	**60**

D. COURSE CONTENT

CHAPTER-1 ENZYMES AND ITS FUNCTION

1.1 Enzymes are proteins and classify them.
1.2 Effect of enzymes on reaction rates not equilibria.
1.3 Reaction rates and equilibria have precise thermodynamic definition.
1.4 Principles behind catalytic power and specificity of enzymes.
1.5 Use of enzymes as binding energy to provide reaction specificity and catalysis.
1.6 Specific catalytic groups contribute to catalysis.

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CHAPTER-2 ENZYME KINETICS

2.1 Kinetics and mechanism of enzyme action
2.2 Substrate concentration and rate of reaction.
2.3 Quantitative expression of relationship between Substrate concentration and Rate of reaction
2.4 V max and Km
2.5 Enzyme catalysing reactions involving two or more Substrate.
2.6 Prove that pre steady state kinetics can provide evidence for specific reaction

CHAPTER-3 ENZYME INHIBITION AND REGULATORY ENZYMES

3.1 Reversible and irreversible enzyme inhibition.
3.2 Effect of P^H on enzyme inhibition
3.3 List the examples of enzymatic reactions.
3.4 Allosteric enzyme is regulated by non-covalent binding of modulators.
3.5 Allosteric organs are exemptions to many general rules.
3.6 Mechanisms of enzyme regulation.

CHAPTER-4 PRODUCTION OF ENZYMES AND SYNTHESIS OF CHEMICALS USING ENZYMES

4.1 Enzyme modification by Site directed Mutagenesis.
4.2 List different enzymes from plant, animal and microbial sources.
4.3 Recovery of enzymes.
4.4 Isolation of soluble enzymes.
4.5 Purification of enzymes.
4.6 Immobilized enzymes.
4.7 Hydrolytic enzymes.

CHAPTER-5 ENZYME IMMOBILIZATION

5.1 Enzyme immobilization.
5.2 List of different immobilized enzyme.

Syllabus Coverage up to I.A
Chapter 1,2,3

E. Books Recommended			
Sl. no	Name of Author	Title of Book	Name of Publisher
1	Nooralabettu Krishna Prasad	Enzyme Technology	PHI
2	J.L. Jain, Sunjay Jain, Nitin Jain	Fundamental of Biochemistry	S. Chand
3	M.Y.Khan Farha Khan	Principles of Enzyme technology	PHI

Th3. BIOPROCESS ENGINEERING

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	6th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. RATIONALE :

Bioprocess engineering is a technique that produces a biological material, such as a genetically engineered microbial strain, for commercial use and to generate value-added products. It encompasses discovery, research, development and the manufacturing and commercialization of products. Products developed include: fuels, food, feed, pharmaceuticals, and a multitude of value-added biomaterials found in and used by all industries. It is very important for a biotechnologist to understand the biological systems; and to understand the role of microorganisms in the upstream processing and importance of downstream processing in biotechnology.

B. Objectives :

After completion of study of Bioprocess Engineering, students will be able to:

1. To evaluate the kinetics and mechanism of enzymatic process
2. To understand the metabolism and microbial growth kinetics
3. Toevaluatethebioreactors,designfeaturesandtheinstrumentationandcontrolof bioreactors
4. To understand the role of downstream processing in biotechnology

C. Topic Wise Distribution of Periods

Sl. No.	Topics	Periods
1	Introduction	10
2.	Fermentation process	15
3	Downstream processing	15
4	Industrial production of chemicals	10
5	Product recovery	10
	Total	**60**

D. COURSE CONTENT

Chapter –1 INTRODUCTION

1.1 Bioreactor: General features, Isolation,
1.2 Preservation and maintenance of industrial microorganisms'
1.3 Kinetics of microbial growth and death: Media and industrial fermentation,
1.4 Air and Media Sterilization.

Chapter-2 FERMENTATION PROCESS

2.1Types of Fermentation Processes: Analysis of Batch
2.2 Fed Batch and Continuous Bioreactor
2.3 Specialized Bioreactor: Pulsed, Fluidized, Photo bioreactor
2.4 Bioprocess Parameters: Measurement and Control

Chapter-3 DOWNSTREAM PROCESSING

3.1 Introduction: General idea on downstream processing
3.2 Processing Procedure: Removal of microbial cells and
Solid matter, foam separation, precipitation, filtration,
Centrifugation, cell disruption and liquid-liquid extraction
3.3 Chromatography: Role of chromatography in downstream processing.
3.4 Purification of products: Membrane process (Dialysis), Drying and Crystallization.

Chapter-4 INDUSTRIAL PRODUCTION OF CHEMICALS

4.1 Methods of cell immobilization and its application s in industries
4.2 Production of Alcohol (Ethanol), solvents (Glycerol and Acetone)
4.3 Antibiotics (Penicillin, Streptomycin, Tetracycline)
4.4 Production of Single Cell Protein.

Chapter-5 PRODUCT RECOVERY

5.1 Sterilization and Pasteurization
5.2 Techniques of food Preservation
5.3 General idea of Packing.

Syllabus Coverage up to I.A
Chapter 1,2,3,4

E. Books Recommended			
Sl. no	Name of Author	Title of Book	Name of Publisher
1	B.Sivasankar	Bio separations: Principles and Techniques	PHI
2	Upadhyay, Upadhyay, and Nath	Biophysical Chemistry Principles and techniques	Himalaya publishing House
3	Michael Shuler and Fikret Kargi.	Bioprocess Engineering: Basic Concepts”	PHI

Th4.(a)PHARMACEUTICAL TECHNOLOGY (ELECTIVE)

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	6th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. RATIONALE:

The progress in the field of Pharmaceutical Industry has been spectacular as substantial technical and scientific growth in the basic sciences has widened its horizons. The recent advances in the field of basic genetics have opened up new vistas, potentials and possibilities. The primary function of the research-based pharmaceutical corporations is to create value by discovering and producing effective medicines, vaccines and services that improve patients' well-being, and can be sold in markets at a profit. Highly proliferating genetic engineering, concepts of bio-cellular synthesis, bioprocesses, immunization, gene cloning for organ culture, monoclonal antibodies as piloting modules in targeted drug delivery, have became reality now. It is expected that pharmaceutical technology will attain a twofold expansion by the turn of this century. Pharmaceutical Industry has boomed in India due to the various reasons like clinical research, research and development related to various vaccines, etc. Various multinational pharmaceutical corporations are outsourcing their research and development activities to India, giving this industry a rise like never before.

B. Objective:

After completion of the study of pharmaceutical technology the student will be able to know about:

1. Significance and growth of pharmaceutical industry
2. The relationship between pharmacy and biotechnology.
3. The different economically important enzymes and their role in industries.
4. Gene therapy and its application for the treatment of different diseases.
5. Different types of drugs and their process of targeting inside the cell.
6. Pharmaceutical applications in cell culture.

C. Topic Wise Distribution of Periods

Sl. No.	Topics	Periods
1	Introduction to Pharmacy	05
2.	Drug kinetics and bio pharmaceutics	15
3.	Principles of drug manufacture	15
4.	Biopharmaceuticals	15
5.	Immunogenicity of biopharmaceuticals	10
	Total	60

D. COURSE CONTENT

Chapter1.0 INTRODUCTION TO PHARMACY

1.1 History of pharmacy
1.2 Pharmaceutical industry & development of drugs
1.3 Some common terms in pharmacy
1.4 Quality management in pharmacy

Chapter 2.0 DRUG KINETICS AND BIO PHARMACEUTICS

2.1 Mechanism of drug absorption, distribution, metabolism and excretion
2.2 Factors affecting the ADME process
2.3 Bioequivalence

Chapter3.0 PRINCIPLES OF DRUG MANUFACTURE

3.1 Liquid dosage forms – solutions, suspensions and emulsions
3.2 Topical applications – ointments, creams, suppositories
3.3 Solid dosage forms – powders, granules, capsules, tablets
3.4 Elementary idea about antibiotics, sulpha drugs, analgesics, synthetic drugs On antimalarial and antiTB, vitamins and synthetic hormones.

Chapter4.0 BIOPHARMACEUTICALS

4.1 Principles of pharmacology
4.2 Pharmacokinetics and Pharmacodynamics.
4.3 Study of a few classes of therapeutics like Recombinant therapeutics, Monoclonal Antibodies, Vaccines, Gene therapy, Antibiotics and Hormones.

Chapter 5.0 IMMUNOGENICITY OF BIOPHARMACEUTICALS

5.1 Immunogenicity
5.2 Factors contributing to immunogenicity (product related factors, Host-related factors)
5.3 Case studies: Erythropoietin, Insulin, DNAs, Factor VIIa, Factor IX, Activated protein C, Monoclonal antibodies etc.

Syllabus Coverage up to I.A
Chapter 1,2,3

E. Books Recommended			
Sl. no	Name of Author	Title of Book	Name of Publisher
1	S P Vyas	Pharmaceutical Biotechnology	CBS
2	H D Kumar	Molecular Biology	Vikash Publishing

Th4(b) FOOD BIOTECHNOLOGY

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	6th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. RATIONALE:

Food Biotechnology is concerned with the design, adaptation and Successful operation of processing plant to produce a suitable stable edible Product from unstable food materials. For the above purpose the students should well acquainted with canning, drying and preservation of food products for a longer period for utilization.

B. Objective:

After completion of the study of Food technology the student will be able to:

1. To know about the principles and methods of food preservation
2. To know the food packaging which helps in the storage of food for a prolonged period
3. To know the sources of contamination and spoilage
4. To know the quality of food products

C. Topic Wise Distribution of Periods

Sl. No.	Topics	Periods
1	Introduction	10
2.	Preservation Technology	10
3.	Food Microbiology	10
4.	Food Analysis	10
5.	Quality control	10
6.	Food Packaging	10
	Total	60

D. COURSE CONTENT

Chapter 1.0 INTRODUCTION

1.1 General introduction to food technology
1.2 Food spoilage
1.3 Different Types of spoilage (Chemical spoilage and Biochemical and Microbial Spoilage)
1.3 Different spoilage agencies (By dirt, dust, chemicals, metals, non-edible plant materials etc, Mechanical injury and physical change, Moisture absorption and desiccation and Concept of water activity)

Chapter 2.0 PRESERVATION TECHNOLOGY

2.1 Principles of food preservation
2.2 Classification of food preservatives (class1and 2)
2.3 Common methods of food preservation
(a) Using sugar
(b) Salting and pickling
(c) Smoking and curing
(d) Sun drying

2.4 The scientific methods of food preservation
(a) Low temperature preservation
(b) Canning
(c) Dehydration
(d) Radiation
(e) Fermentation
(f) Chemical preservatives like benzoic acid, KMS, Sodium benzoate

Chapter3.0 FOOD MICROBIOLOGY

3.1 Microbiology of foods
(a) Milk & Milk products
(b) Meat, Fish, Poultry and eggs
(c) Fruits and vegetables
(d) Cereals products.

3.2 The sources of contamination and spoilage

3.3 Micro-organisms in processed foods (such as bread, idli, Fermented products, curd, Cheese, wines, beers, vinegar)

Chapter4.0 FOOD ANALYSIS

4.1 analysis of food

4.2 ingredients present in different product

4.3 Outline of methods of determination of food attributes like
(a) Colour
(b) Size and shape
(c) Viscosity and consistency
(d) Texture (e) Flavour

Chapter 5.0 QUALITY CONTROL

5.1 Different types of quality control techniques (Statistical quality control and Microbiological quality control)

5.2 The methodology of Sensory evaluation of food quality (triangular test ranking, hedonic Scale, flavour profile)

5.3 Quality control in bakery industry, of raw material, of finished products, of packaging Materials

E. Books Recommended			
Sl no	Name of Author	Title of Book	Name of Publisher
1	N. N Potter	Food Science	CBS Publication
2	G. Reed, Prescott and Dunn	Textbook on microbiology	CBS Publication
3	Moris, Chapman & Hall	Principles of food Preservation	McGraw Hill
4	R. Lees, C. R.C.	Food Analysis	Press Inc
5	Open source learning from Internet		

Th4(c) VACCINE BIOTECHNOLOGY

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	6th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. RATIONALE: To understand the conventional strategies in vaccine production and to keep in pace with the emerging trends in the field of vaccine biotechnology. Vaccination, the administration of an antigenic material (vaccine), is considered to be the most effective method for disease prevention and control. A vaccine usually contains an agent that resembles a diseases-causing pathogen and is often made from inactivated microbes, live attenuated microbes, its toxins, or part of surface antigens (subunit). However, the modern biotechnological tools and genomics have opened a new era to develop novel vaccines and many products are successfully marketing around the world. It is important to formulate and deliver these vaccines appropriately to maximize the potential advances in prevention, therapy, and vaccinology. New vaccines employing biotechnological innovations are helping us to change the way for illness prevention.

B. Objective: After completion of study of Vaccine Biotechnology the students will be able to:

1. Acquire theoretical knowledge on conventional to recent technology of vaccine production.
2. Learn the type of vaccine ,immunological effect and regulatory guidelines.

C.Topic Wise Distribution of Periods

Sl No.	Topics	Periods
1	Historical development of vaccine	12
2	Better production	12
3	Types, Methods and application	12
4	Delivery methods	12
5	Guideline for the management	12
	Total	60

D. COURSE CONTENT

Chapter 1.0 HISTORICAL DEVELOPMENT OF VACCINE

1.1 History of vaccine development -Conventional strategies for vaccine improvement; Current development in vaccines
1.2 Live, attenuated, subunit, peptide and killed vaccine
1.3 Types of adjuvant
1.4 Quality control, preservation and monitoring of micro organisms in seed lot system

Chapter 2.0 BETTER PRODUCTION

2.1 Technology related to monitoring temperature, sterilization, environment, quality assurance and related Areas.

2.2 Production techniques –growing the microorganisms in maximum titer

2.3 Preservation techniques , freeze drying

Chapter 3.0 TYPES OF METHODS AND APPLICATION

3.1 Vaccine efficacy, types of vaccines- Inactivated toxins, Inactivated whole bacteria or viruses, Live attenuated bacteria or viruses.

3.2 Subunit vaccines, Polysaccharide vaccines, Conjugated vaccines.

3.3 Recombinant DNA vaccines, Edible vaccines, Virus like particles

3.4 Uses of nanoparticles in vaccine application- Nanoparticles in vaccine delivery, Induction of immune responses by nanoparticles based vaccine

Chapter 4.0 DELIVERY METHOD

4.1 Immunomodulators-Innovative methods of delivering immunogens; liposome's-role of liposomes in delivering vaccines-Mechanism of liposome formation

4.2 Microspheres-Types of microspheres, Preparation methods

4.3 ISCOMS-Properties of ISCOM based vaccines, Types, components of ISCOM

Chapter 5.0 GUIDELINE FOR THE MANAGEMENT

5.1 Regulatory issues- Regulatory bodies, Environmental effects of recombinant vaccines.

5.2 Disease security and bio security principles| OIE guidelines for vaccine seed lot management.

5.3 OIE guidelines for the method of vaccine production, OIE guidelines for production facility.

5.4 In process control and batch control-organization and responsibilities, documentation and evaluation of data Test on final products-Overview, General manufacturing recommendations, Final product release tests.

E. Books Recommended			
Sr. no	Name of Author	Title of Book	Name of Publisher
1	Ronald W.Ellis	New Vaccine Technologies	Landes bioscience
2	Emily P. Wen,Ronald Eliis, Narahari s. pujar	Vaccine development and manufacturing	Wiley
3	Vipin M. Vashistha	IAP text book of vaccines	Jaypee brothers Medical publishers
4	Dulsy Fatima N Arumugam	Immunology	Saras publication
5	Open source learning from Internet		

Pr1. PLANT SAFETY MANAGEMENT LABORATORY

Common to Chemical, Biotechnology & Food Technology

Practical:3Periods per Week	Sessional: 25 marks
Total periods:45 Periods	Practical Examination:25 marks
Examination: 3 Hours	Total Marks: 50 Marks

A. Rationale:

Workplace safety is very important for each and every employee in the industry because all the workers desire to work in a safe and protected atmosphere. Health and safety is the key factor for all the industries in order to promote the wellness of both employees and employers. It is a duty and moral responsibility of the company to look after the employee's protection.

Students will learn the to use basic safety equipments used in industry through practically using it in Laboratory

B. **Objectives :**

After completion of Practical of Plant Safety Management Practice, the student will be able to :

1. Use personal protective equipment properly in work place
2. Understand the understand the causes of industrial disaster
3. Can distinguish types of fire and can extinguish small scale fire
4. Provide first aid to accident victims

Experiment Wise Distribution of Periods

SL. No.	Experiment	Period
1	Demonstration of Personal Protective Equipment such as Nose Mask, various types of Safety goggles etc	06
2	Use of Fire extinguisher	09
3	Hazop and Hazon Study	06
4	Analysis of cases of Industrial disaster	03
5	Study on latest advances in PPE	06
6	First Aid Training	15
	Total	45

Pr2. BIOPROCESS ENGINEERING LAB

Practical:6Periods per Week	Sessional: 50 marks
Total periods:90 Periods	Practical Examination:50 marks
Examination: 3 Hours	Total Marks: 100 Marks

Rationale: Enables the student to develop their skills in the field of bioprocess to understand the basic principles using biocatalysts, kinetic studies, and microbial fermentation for production of bio products. Provides an opportunity to experimentally analyse the theoretical concepts studied in Bioprocess Engineering. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.
Students will learn the kinetics of reaction through practically using laboratory Equipments used in the bioprocess industry.

A. **Objectives :**

After completion of Practical of Reaction Engineering, the student will be able to:

1. Understand working, construction and operation of different reactors used in industry
2. Understand the principle of kinetics of reactions used in the Bio-Process industry
3. Produce value added byproducts by applying fermentation skills
4. To understand the importance of sterilization kinetics
5. Analyze the growth kinetics of microorganisms and estimation of their kinetic parameters

Experiment Wise Distribution of Periods

Sl No.	Experiment	Period
1	Isolation of industrially important organism for microbial process.	10
2	Determination of thermal death point of microorganism.	10
3	Determination of growth of microorganism	10
4	Determination of substrate degradation profile..	10
5	Ethanol production using different substrate.	07
6	Growth kinetics of yeast- evaluation of specific growth rate, yield coefficient and doubling time.	07
7	Growth kinetics of bacteria- evaluation of specific growth rate, yield coefficient and doubling time.	06
	Total	**60**

Pr3. PROJECT Phase - II

Name of the Course: Diploma in Bio Technology			
Course code:		Semester	6th
Total Period:	135	Examination	3 hrs
Lab. periods:	9 P / week	Sessional	75
Maximum marks:	175	End Sem Examination	100

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Biotech and practices in real life situations, so as to participate and manage a large Bio Tech projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

Project Phase-I and Phase-II

The Project work duration covers 2 semesters(5^{th} and 6^{th} sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5^{th} semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-II in 6^{th} semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	**Performance Criteria**
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the

students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

Organization of Project Report

1. Cover page:
   It should contain the following (in order)

   (i) Title of the Project
   (ii) "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"
   (iii) By Name of the Student(s)
   (iv) Logo of the Institution
   (v) Branch Name/Depart Name and Institution Name with Address
   (vi) Academic Year
2. 1st Inner page
   Certificate:

   It should contain he following

   "This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

   Seal and signature of the Supervisor/Guide with date
3. 2nd Inner Page
   Acknowledgement by the Student(s)
4. Contents.
5. Chapter wise arrangement of Reports
6. Last Chapter: Conclusion
   It should contain

   (i) Conclusion
   (ii) Limitations
   (iii) Scope for further Improvement
7. References

Pr-4 LIFE SKILL

(Common to All Branches)

Practical	**2 Periods per week**	**Sessional**	**25 Marks**
Total Periods	**30 Periods**	**Total Marks**	**25 Marks**

Objective: After completion of this course the student will be able to**:**

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

DETAIL CONTENTS:

1. SOCIAL SKILL

Society, Social Structure, Develop Sympathy and Empathy
Swot Analysis – Concept, How to make use of SWOT
Inter personal Relation**:** Sources of conflict, Resolution of conflict ,
Ways to enhance interpersonal relation

2. PROBLEM SOLVING

Steps of Problem solving**:**

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

3. PRESENTATION SKILL

Body language , Dress like the audience
Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,
Voice and language – Volume, Pitch, Inflection, Speed, Pause
Pronunciation, Articulation, Language, Practice of speech.
Use of AV aids such as Laptop with LCD projector, white board etc.

4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES

Group Discussion:
Introduction to group discussion, Ways to carry out group discussion,
Parameters— Contact, body language, analytical and logical thinking,
decision making
Interview Technique :
Dress, Posture, Gestures, facial expression, Approach
Tips for handling common questions.

5. WORKING IN TEAM

Understand and work within the dynamics of a groups.
Tips to work effectively in teams,
Establish good rapport, interest with others and work effectively with them
to meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, Handling frustrations in group.

6. TASK MANAGEMENT

Introduction, Task identification, Task planning ,
organizing and execution, Closing the task

PRACTICAL

List of Assignment: *(Any Five to be performed including Mock Interview)*

1. SWOT analysis:-

Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.

a) Your past experiences,
b) Achievements,
c) Failures,
d) Feedback from others etc.

2. Solve the True life problem assigned by the Teacher.

3. Working in a Team

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.(One activity per group where Team work shall be exhibited)

4. Mock Interview

5. Discuss a topic in a group and prepare minutes of discussion.

6. Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.

7. Task Management

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

Note: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.
Note: -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

METHODOLOGY:

The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.

Books Recommended:-

Sl.No	Name of Authors	Title of the Book	Name of the Publisher
01	E.H. Mc Grath , S.J	Basic Managerial Skills for All	PHI
02	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
03	Adair, J	Decision making & Problem Solving	Orient Longman
04	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
05	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.

BIOTECHNOLOGY SEMESTER-6

PLANT SAFETY MANAGEMENT LABORATORY		
Sl.	Name of equipment with specification	Quantity per student strength up to 30
1	Personal protective equipment for head, eye, ear protection	01 set
2	Fire extinguisher-CO_2 type, dry powder type	02 no each
3	First Aid kit	04 set
BIOPROCESS ENGINEERING LABORATORY		
Sl.	Name of equipment with specification	Quantity per student strength up to 30
1	Conical flask-100ml, 250ml,500 ml	02
2	Volumetric flask-100ml, 250ml	02 no each
3	Burrete-50 ml with complete fitting	02 no each
4	Reagent bottle-250ml	05 no
5	Funnel- different size	02 no
6	Beaker-250 ml and 500 ml	05 no
7	Pipette- 10 ml, 25 ml	05 no
8	Measuring cylinder-10 ml,50 ml,100 ml	01each
9	Batch Reactor laboratory model	01each
10	Tubular Flow Reactor laboratory model	01each
11	Continuous Stirred Tank Reactor laboratory model	01each
12	Packed bed reactor laboratory model	01each
2	Volumetric flask-100ml, 250ml	02 no each
4	Reagent bottle-250ml	05 no
6	Beaker-250 ml and 500 ml	05 no
7	Pipette- 10 ml, 25 ml	05 no
8	Measuring cylinder-10 ml,50 ml,100 ml	01no
10	Digital balance	01no
11	Bacteriological Incubator Gravity Convection , thermostatic, Anhydric atmosphere, For use on 220/230 volts 50 cycles single phase AC only.	01no
12	Hot Air Oven 5°C above ambient to 250°C maximum Doors - Solid doors w/ silicone rubber gasket & lock Shelves 2 – 3 Stainless steel shelves (Removable) Air Circulation Forced air circulation Power Supply 220 Volts	01no