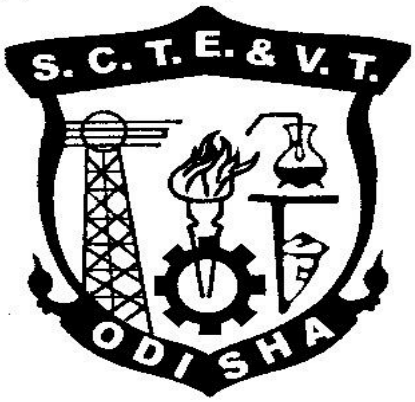
CURRICULLUM OF 3RD SEMESTER

For

DIPLOMA IN BIOTECHNOLOGY

(Effective FROM 2019-20 Sessions)



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

SALIENT FEATURES OF THE DIPLOMA PROGRAMME IN BIOTECHNOLOGY

1. Name of the Program : Diploma Program in BIOTECHNOLOGY

2. Duration of the Program: Three Years

3. Entry Qualifications : Matriculation or equivalent as prescribed by AICTE.

4 Pattern of the Program : Semester Pattern

JOB OPPORTUNITIES

Employment opportunities for diploma holder in BIOTECHNOLOGY are visualized in following industries at various levels/positions:

(i) Biotechnology and Allied Industries like

(a) Pharmaceutical industry
(b) Tissue culture Laboratory
(c) Aquaculture field
(d) Research Laboratory
(e) Dairy
(f) Seed producing plants
(g) Fine chemical industry
(h) Breweries
(i) Mineral water industry
(j) Food Processing industry
(k) Consumer goods industry
(l) Chemical process industry
(m) Food industry
(n) Agro industry
(o) Leather industry
(p) Pharmaceutical industry
(q) Distilleries
(r) Plantation
(s) Fertilizer Industry

In various functional areas like erection and commissioning of plant, plant operation, production, maintenance and safety, quality control, inspection and testing, marketing and sales, consultancy services and areas concerning environmental protection.

(ii) Research Organizations like CSIR laboratories, Defense laboratories, Atomic energy establishments etc.

(iii) Entrepreneurs to small/tiny units especially food, agro and biochemical industries.

COURSE OBJECTIVES

Keeping in view the employment opportunities of diploma holders in Biotechnology, the course is aimed at developing following knowledge and skills in the students:

1. Basic understanding of concepts and principles related to applied sciences as a foundation for further studies.
2. Development of communication and interpersonal skills for effective functioning in the world of work.
3. Understanding of basic concepts and principles of mechanical, electrical and civil engineering so as to enable the students to apply the knowledge of these principles to the field of Biotech engineering.
4. Ability to read and interpret drawings related to plant layout, process equipment and components.
5. Knowledge of various materials used in Biochemical processes, their properties and specifications.
6. Knowledge and associated skills of various unit operations, unit processes and process instrumentation in process industry.
7. Ability to calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process.
8. Ability to control the process and quality of the products commiserating with laid specifications.
9. Understanding of basic principles of managing men, material and machines/ equipment for optimum production.
10. Appreciation of the need of clean environment and its deterioration by various emissions from industry and preventive procedures and knowledge of safety regulations in process industry.
11. Development of generic skills of thinking and problem-solving, communication, attitudes and value system for effective functioning in a process industry.
12. Proficiency in the use of computers.
13. Basic manual and machining skills as an aid to function effectively in the process industry.
14. Knowledge of testing and quality control activities.
15. Detailed knowledge of Biotechnology and Biochemical products along with processes involved in their production.
16. Detailed knowledge of fertilizers and technology involved in their production along with important Biotechnology plants in India.
17. Development of good personality in order to have effective communication and business ethics.

4. DERIVING CURRICULUM AREAS FROM COURSE OBJECTIVES

The following curriculum areas have been derived from course objectives.

Sr. No.	**Curriculum Objectives**	**Curriculum Areas/Subjects**
1.	Basic understanding of concepts and principles related to applied sciences as a foundation for further studies.	- Applied Physics - Applied Chemistry - Applied Mathematics
2.	Development of communication and interpersonal skills for effective functioning in the world of work.	- Communication Skills
3.	Understanding of basic concepts and principles of mechanical, electrical and civil engineering so as to enable the students to apply the knowledge of these principles to the field of bioprocess engineering.	- General Engineering

4.	Ability to read and interpret drawings related to plant layout, process equipment and components.	- Engineering Drawing - Process Equipment Design & Drawing
5.	Knowledge of various materials used in biochemical processes, their properties and specifications.	- Microbiology - Biochemistry - Cell Biology
6.	Knowledge and associated skills of various unit operations, unit processes and process instrumentation in process industry.	- Introduction to Biotechnology - Fluid Flow - Heat Transfer - Separation operation - Mass Transfer - Process Instrumentation - Engineering Thermodynamics - Process Utilities
7.	Ability to calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process.	- Introduction to Biotechnology
8.	Ability to control the process and quality of the products commiserating with laid specifications.	- Elective/Specializations - Pharmaceutical Industries - Plant Biotechnology - Industrial Biotechnology - Bioinformatics
9.	Understanding of basic principles of managing men, material and machines/ equipment for optimum production.	- Entrepreneurship Development and Management
10.	Appreciation of the need of clean environment and its deterioration by various emissions from industry and preventive procedures and knowledge of safety regulations in process industry.	- Environmental Engineering and Safety - Plant Safety Management
11.	Development of generic skills of thinking and problem-solving, communication, attitudes and value system for effective functioning in a process industry.	- Industrial Visits - Project Work
12.	Proficiency in the use of computers.	- Computer Applications in Engineering - Basics of Information Technology
13.	Basic manual and machining skills as an aid to function effectively in the process industry.	- General Workshop Practice
14.	Knowledge of testing and quality control activities.	- Biochemical Process Industries
15.	Development of good personality in order to have effective communication and business ethics.	- Student Centered activity

ABSTRACT OF CURRICULUM AREAS/SUBJECTS

(a) Basic Sciences and Humanities

1. Communication Skills
2. Basics of Information Technology
3. Entrepreneurship Development and Management

(b) Applied Sciences

4. Applied Mathematics
5. Applied Physics
6. Applied Chemistry
7. Organic Chemistry
8. Physical Chemistry
9. Basic Life Science

(c) Basic Courses in Engineering/Technology

10. Engineering Drawing
11. General Workshop Practice
12. General Engineering

(d) Applied Courses in Engineering/Technology

10. Introduction to Biotechnology
11. Industrial Microbiology
12. Biochemistry
13. Cell biology
14. Molecular Biology
15. Genetic Engineering
16. Immunology & Enzyme engineering
17. Fluid Flow
18. Heat Transfer
19. Mass Transfer
20. Environmental Engineering and Safety
21. Process Instrumentation
22. Biochemical Process Industries
23. Plant Safety Management
24. Computer Applications in Biotechnology
25. Minor Project
26. Major Project

(e) Specialized Courses in Engineering/Technology)
(Electives, any one of the following)

27. Food Biotechnology
28. Industrial Biotechnology
29. Pharmaceutical Biotechnology
30. Bioinformatics

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 3rd Semester (Biotechnology)(wef 2019-20)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional:	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Physical Chemistry(C)	4		-	20	80	3	100
Th.2		Basic Life Science	4		-	20	80	3	100
Th.3		Introduction to Biotechnology	4		-	20	80	3	100
Th.4		Cell and Molecular Biology	4			20	80	3	100
Th.5		Environmental studies(C)	4			20	80	3	100
		Total	20			100	400	-	500
		Practical							
Pr.1		Physical Chemistry Lab(C)	-	-	4	50	25	3	75
Pr.2		Introduction to Biotechnology Lab	-	-	4	25	25	3	50
Pr.3		Cell and Molecular Biology Lab	-	-	5	50	50	3	100
Pr.4		Environmental Engg. Lab(C)		-	3	25	-	3	25
		Student Centred Activities(SCA)			3	-	-	-	-
		Total	-	-	*19*	*150*	*100*	-	*250*
		Grand Total	**20**	**-**	**19**	**250**	**500**	**-**	**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 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. PHYSICAL CHEMISTRY

(Common to Chemical, Biotechnology & Food Technology)

Name of the Course: Diploma in Biotechnology			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

The phenomenal progress of technology in the 20th century has brought dramatic changes in human life styles. The technology, which has thus enhanced the quality of human life, is evolved based on scientific research, primarily physical, inorganic and organic Chemistry. Use of various organic and inorganic compounds and their physical phenomenon are very much essential for any process industry. Therefore the knowledge of Chemistry is necessary for the success of Chemical Engineers, Biotechnologists and Food Technologists.

B. OBJECTIVE:

After completion of study of Physical Chemistry the student will be able :

1. To Conceptualize physical properties of liquid.
2. To Understand solution and its properties.
3. To understand the concept of Osmosis and Osmotic Pressure.
4. To Explain distribution law.
5 To. Understand the concept of colloids.
6. To understand the concept of Adsorption.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Physical Properties of Liquids	10
2.	Solutions	12
3.	Osmosis and Osmotic Pressure	12
4.	Distribution Law	08
5.	The Colloids	10
6.	Adsorption	08
	Total	**60**

D. COURSE CONTENTS

1. PHYSICAL PROPERTIES OF LIQUIDS

1.1. Intermolecular forces in liquid.
1.2. Vapour pressure and its effect on temperature and boiling point.
1.3. Surface tension.
1.4. Viscosity and measurement of viscosity by Ostwald method.
1.5. Refractive index, specific refraction, determination of refractive index
1.6. Optical activity and measurement of optical activity.
1.7. Solve simple problems based on physical properties of liquid.

2. SOLUTIONS

2. 1 Solution and Types of solutions.
2. 2 Ways of expressing concentration.
2. 3 Solve numerical related to concentration.
2. 4 The solution of gases in gases.
2. 5 Henry's law and solve numerical related to it.
2. 6 Solutions of liquid in liquids.
2. 7 Solubility of partially miscible liquids
2. 8 Solubility of solid in liquid and equilibrium concept, solubility curve.
2. 9 Raoult's Law, ideal solution and explain the lowering of vapour pressure and its measurement.
2. 10 Concept of elevation of boiling point and depression of freezing point.

3. OSMOSIS AND OSMOTIC PRESSURE

3 . 1 Osmosis and osmotic pressure with example.
3 . 2 Function of semi permeable membrane.
3 . 3 Osmotic pressure and isotonic solutions.
3 . 4 The theories of Osmosis.
3 . 5 Reverse osmosis.
3 . 6 The laws of osmotic pressure.
3 . 7 Solve the Simple Problems.
3 . 8 Relation between Vapour Pressure & Osmotic Pressure.

4. DISTRIBUTION LAW

4.1 Nernst's distribution law.
4.2 Equilibrium constant from distribution coefficient.
4.3 Extraction with a solvent, multiple extraction.
4.4 Concept of liquid-liquid chromatography.
4.5 Applications of distribution law.
4.6 Numerical based on distribution law.

5. COLLOIDS

5 . 1 Colloids & types of colloidal systems.
5 . 2 Characteristics of sols.
5 . 3 The application of colloids.
5 . 4 Methods of preparation of sols & purification of sols.
5 . 5 The optical, kinetic and electrical properties of sols.
5 . 6 Emulsion and types of emulsion.

5 . 7 The role of Emulsifier.
5 . 8 The preparation of Emulsions and their properties.
5 . 9 Gel, type of gel, properties and application.

6. ADSORPTION

6. 1 Adsorption
6. 2 Compare absorption and adsorption
6. 3 Types of adsorption.
6. 4 Physical adsorption and Chemisorption.
6. 5 The application of adsorption
6. 6 The Ion- exchange adsorption and discuss its application

Syllabus coverage up to Internal assessment

Chapter : 1,2,3,4

.

E. Books Recommended :

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	B.S. Bahl, H.D. Tuli, A. Bahl	Essentials of Physical Chemistry	S. Chand & Co.
2	A Text book of physical chemistry	K.K. Sharma & L.K. Sharma	Vikas Publishing

Th2. BASIC LIFE SCIENCE

Name of the Course: Diploma in Biotechnology			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

From the pre-historic time, man knew the utilization of plants and animals in various ways. He had the practical interest and curiosity to know the phenomenon of the nature. Primitive man used many wild plants for shelter food, medicine, tools and other purposes. He was also hunting animals for his food and could know how to defend himself from predators. For this, he knows about the habit, habitat and behaviors of various animals and plants. Later useful animals and plants were recognized and man formed stable association with them. This interest of man in animals and plants around him, led the foundation of biology (Basic Life Science)

Topic wise distribution of periods

B. OBJECTIVE:

1. After completion of study of Basic Life Sciences the student will be able :
2. To know the scope and different aspects of biology in relation to mankind and the Society.
3. To know about the important elements of cell and their physical and chemical behavior.
4. To know the structure and function of the different systems and their importance for continuation of life in brief.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Introduction to Biology	10
2.	Morphology and Anatomy	10
3.	Continuity of Life	10
4.	Nutrition	09
5.	Respiration	12
6.	Transport	09
	Total	**60**

D. COURSE CONTENTS:

1. INTRODUCTION TO BIOLOGY

1.1. Concept of Botany

1.2. Concept of Zoology

1.3. Five kingdom Classification

2. MORPHOLOGY AND ANATOMY

2. 1 Tissue- Plant and Animal

2. 2 Morphology of flowering plants

3. CONTINUITY OF LIFE

3 . 1 Mendel's laws of inheritance.

3 . 2 Sex linked inheritance.

4. NUTRITION

4.1 Photosynthesis.

4.2 Digestive system and process of digestion in human being.

5. RESPIRATION

5 . 1 Cellular respiration.

5 . 2 Structure and function of ATP.

5 . 3 Concept of fermentation.

6. TRANSPORT

6 . 1 Plant water relationship

6 . 2 Transport of water and minerals in plants

6 . 3 Fundamentals of transpiration.

6 . 4 Circulation of blood in human body.

Syllabus Coverage up to Internal assessment

Chapter 1,2,3,4

E. Books Recommended :

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	A.K. Nanda	Text book of Botany	Kitab Mahal
2	S.Pati, R.R.Nanda and K.K.Ghosh	Text book of Zoology	Kitab Mahal

Th3. INTRODUCTION TO BIOTECHNOLOGY

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

The term Biotechnology was coined during late 1970s when the advances in molecular and cell biology catalysed new industrial ventures to exploit these advances for the benefit of mankind. The European Federation of Bio-technology has defined Biotechnology as the integrated use of biochemistry, microbiology and engineering sciences in order to achieve technological or industrial application of capabilities of micro organisms. In simple terms, Biotechnology is the use of living organisms to make products of value of man. The use of term biotechnology may imply a single subject, but the essence of biotech is its multi disciplinary nature. Biotechnology has involved from integrated use of life sciences, chemical sciences and engineering sciences.

B. OBJECTIVE:

1. After completion of the study of Introduction to Biotechnology the student will be able :
2. To know about biotechnology and its relation to society and mankind.
3. To know about different branches of biotechnology and their utility to improve the life style. 3. To know about different discoveries related to biotechnology and their application to improve the mankind.
4. To Know about the medicines and antibiotics produced by manipulation and application of some bio-technological processes.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Biotechnology	10
2.	Genes and Genetics	15
3.	Environmental Biotechnology	10
4.	Animal Biotechnology	15
5.	Biotechnology and Biosafety	10
	Total	**60**

D.COURSE CONTENTS

1. **BIOTECHNOLOGY**
   - 1.1. Introduction of Biotechnology
   - 1.2. Traditional and modern biotechnology
   - 1.3. Different disciplinary of Biotechnology
   - 1.4. Applications of biotechnology
   - 1.5. Global impact of Biotechnology.
2. **GENES AND GENETICS**
   - 2. 1 Basic concept of DNA
   - 2. 2 PCR Technology .
   - 2. 3 Watson and Cricks model of DNA
   - 2. 4 Structure of RNA
   - 2. 5 Genes and Genome.
3. **ENVIRONMENTAL BIOTECHNOLOGY**
   - 3.1. Bioremediation
   - 3.2. Xenobiotics
   - 3.3. Bioagumentation
   - 3.4. Vermicomposting
   - 3.5. Microbial Leaching
4. **ANIMAL BIOTECHNOLOGY**
   - 4.1 Main terminology in cell culture
   - 4.2 Minimal requirements for animal cell culture
   - 4.3 Media composition of animal cell culture
   - 4.4 Some examples of transgenic animals (like Dolly)
   - 4.5 Some application of animal cell culture
5. **BIOTECHNOLOGY AND BIOSAFETY**
   - 5 . 1 Biosafety guideline and Regulations
   - 5 . 2 IPR and IPP
   - 5 . 3 WIPO, GATT, TRIPS
   - 5 . 4 Patenting of Biological materials
   - 5 . 5 Significance of patents in India

Syllabus Coverage up to Internal assessment

Chapter 1,2,3,4

A. Books Recommended

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	U.Satyanarayan	Text book of Biotechnology	Books & allied (p) ltd.
2	B.D.Singh	Biotechnology, an expanding horizon	Kalyani publishers.
3	D. Burglarize, T.R.Jewell & R.G.Buiser	Biotechnology: Demystifying the concept	Pearson EducationPubl.
4	A.Borem, F.R.Sautaos & D.E.Bower	Understanding Biotechnology	Pearson Education Publ.

Th4. CELL AND MOLECULAR BIOLOGY

Name of the Course: Diploma in Biotechnology			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

All animals and plants consist of certain structural units called cells. Living things therefore can be defined as those objects, which are composed of cells capable of reproduction. In recent years, large number of sub-cellular structures have been discovered and studied in detail. Consequently, it may appear that cell is no longer a basic unit of life, because life may exist without cells also. It should however be realised that the importance of the atomic theory in physics and chemistry did not decrease with the discovery of smaller particles like protons, neutrons and electrons.

B. OBJECTIVE:

1. After completion of the study of Cell Biology the student will be able to know:
2. About the cell structure and functions related to physiology.
3. About the physical and chemical nature of cell and their effect on cellular functions.
4. About the typical characteristics and functioning of cell which enables it to regulate different physio chemical and biochemical process.
5. About the controlled and uncontrolled growth of cell and their effect on human life and physiology.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Cell Structure	10
2.	Cell growth and Division	10
3.	Replication and maintenance of genomic DNA	10
4.	DNA Transcription	15
5.	Translation	15
	Total	**60**

C. COURSE CONTENT:

1. CELL STRUCTURE

1.1. Introduction to cell Biology
1.1. Prokaryotic and Eukaryotic cells
1.2. Cell structure and functions
1.3. Nucleus, Nucleosome and Chromosome

2. CELL GROWTH AND DIVISION

2. 1 Cell cycle: phases of cell cycle
2. 2 Mitosis and Meiosis.
2. 3 Cytoskeleton: Actin and Myosin

3. REPLICATION AND MAINTENANCE OF GENOMIC DNA

3 . 1 DNA Replication.
3 . 2 Recombination
3 . 3 DNA Damage and repair

4. DNA TRANSCRIPTION

4.1 Different Components of transcription machinery in prokaryotes and eukaryotes
4.2 Different Transcription factors
4.3 Transcription process (Initiation, Elongation, and Termination)
4.4 Different steps involved in m-RNA processing
4.5 Pre and Post transcriptional processing?
4.6 Capping and poly (A) tailing
4.7 m-RNA stability-RNA editing

5. TRANSLATION

5.1. Genetic code (the principle of translation)
5.2. Main Translation machinery (t-RNA, Aminoacyl synthetase, Ribosome),
5.3. Translation process (Initiation, Elongation, and Termination) Process
5.4. Post translational process
5.5. Regulation of Gene Expression: Constitutive and Induced gene expression
5.6. Regulation of gene expression in prokaryotes and eukaryotes
5.7. Operon model (Lac-operon and Trp- operon)

Syllabus coverage up to Internal assessment

Chapter 1,2,3,4

D. Books Recommended

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1.	Geottrey M. Copper	The cell a molecular approach	Sinauer Associates
2.	C.B Power	Cell Biology	Himalaya Publishing House
3.	Watson ,Albert's	Molecular Biology of cell	Garland Science

Th5. ENVIRONMENTAL STUDIES

(Common to all Branches)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination :	3 hrs
Theory periods:	4P / week	Internal Assessment:	20
Maximum marks:	100	End Semester Examination ::	80

A. RATIONALE:

Due to various aspects of human developments including the demand of different kinds of technological innovations, most people have been forgetting that, the Environment in which they are living is to be maintained under various living standards for the preservation of better health. The degradation of environment due to industrial growth is very much alarming due to environmental pollution beyond permissible limits in respect of air, water industrial waste, noise etc. Therefore, the subject of Environmental Studies to be learnt by every student in order to take care of the environmental aspect in each and every activity in the best possible manner.

B. OBJECTIVE:

After completion of study of environmental studies, the student will be able to:

1. Gather adequate knowledge of different pollutants, their sources and shall be aware of solid waste management systems and hazardous waste and their effects.
2. Develop awareness towards preservation of environment.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	The Multidisciplinary nature of environmental studies	04
2	Natural Resources	10
3	Systems	08
4	Biodiversity and it's Conservation	08
5	Environmental Pollution	12
6	Social issues and the Environment	10
7	Human population and the environment	08
	Total:	**60**

D. COURSE CONTENTS

1. The Multidisciplinary nature of environmental studies:

1.1 Definition, scope and importance.

1.2 Need for public awareness.

2. Natural Resources:

Renewable and non renewable resources:

2.1 Natural resources and associated problems.

2.1.1. Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.

2.1.2. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

2.1.3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

2.1.4. Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, .

2.1.5. Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

2.1.6. Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.

2.2 Role of individual in conservation of natural resources.

2.3 Equitable use of resources for sustainable life styles.

3. **Systems:**

3.1. Concept of an eco system.

3.2. Structure and function of an eco system.

3.3. Producers, consumers, decomposers.

3.4. Energy flow in the eco systems.

3.5. Ecological succession.

3.6. Food chains, food webs and ecological pyramids.

3.7. Introduction, types, characteristic features, structure and function of the following eco system:

3.8. Forest ecosystem:

3.9. Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries).

4. **Biodiversity and it's Conservation:**

4.1. Introduction-Definition: genetics, species and ecosystem diversity.

4.2. Biogeographically classification of India.

4.3. Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optin values.

4.4. Biodiversity at global, national and local level.

4.5. Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

5. **Environmental Pollution:**

Definition Causes, effects and control measures of:

5.1.1 Air pollution.
5.1.2 Water pollution.
5.1.3 Soil pollution
5.1.4 Marine pollution
5.1.5 Noise pollution.
5.1.6 Thermal pollution
5.1.7 Nuclear hazards.

5.1. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
5.2. Role of an individual in prevention of pollution.
5.3. Disaster management: Floods, earth quake, cyclone and landslides.

6. **Social issues and the Environment:**

6.1. Form unsustainable to sustainable development.
6.2. Urban problems related to energy.
6.3. Water conservation, rain water harvesting, water shed management.
6.4. Resettlement and rehabilitation of people; its problems and concern.
6.5. Environmental ethics: issue and possible solutions.
6.6. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
6.7. Air (prevention and control of pollution) Act.
6.8. Water (prevention and control of pollution) Act.
6.9. Public awareness.

7. **Human population and the environment:**

7.1. Population growth and variation among nations.
7.2. Population explosion- family welfare program.
7.3. Environment and human health.
7.4. Human rights.
7.5. Value education
7.6. Role of information technology in environment and human health.

Syllabus coverage up to Internal assessment

Chapters: 1, 2 and 3.

Learning Resources:

Sl.No	Title of the Book	Name of Authors	Name of Publisher
1.	Textbook of Environmental studies	Erach Bharucha	#UGC
2.	Fundamental concepts in Environmental Studies	D.D. Mishra	S.Chand & Co-Ltd
3.	Text book of Environmental Studies	K.Raghavan Nambiar	SCITECH Publication Pvt. Ltd.
4.	Environmental Engineering	V.M.Domkundwar	Dhanpat Rai & Co

Pr1. PHYSICAL CHEMISTRY LABORATORY

Common to Chemical, Biotechnology & Food Technology

Name of the Course: Diploma in Biotechnology			
Course code:		Semester	3rd
Total Period:	45	Examination	3 hrs
Lab. periods:	4P / week	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

A. RATIONALE: In view of the fact that there are, as a rule, available for laboratory work' not more than two and one-half hours at a time, it has been found desirable to have the different pieces of apparatus set up beforehand by the instructor. To this end, each experiment is preceded by an exact list of the apparatus and chemicals needed. It is believed that this will materially aid the instructor in assembling the necessary equipment. At the Rensselaer Polytechnic Institute, the laboratory course immediately follows the completion of the theoretical course in physical chemistry, and students are thus prepared to take up the study of any experiment herein listed. It is therefore found practical to prepare the equipment for one or two units of each exercise before the laboratory course starts, and to shift the student successively from one experiment to another. In this way, an excessive amount of preparatory work is avoided.

B. OBJECTIVE:

On completion of the lab course the student will be able to:

1. Understand the interconnection between experimental foundation and underlying theoretical principles and to appreciate the limitations inherent in both theoretical treatments and experimental measurements.
2. Gain familiarity with a variety of physico-chemical measurement techniques.
3. Develop laboratory skills and the ability to work independently.
4. Name salts, acids, bases and covalent compounds and provide formulas for these given a molecular formula.
5. Explain the difference between solubility and dissociation in water and apply this knowledge to acids, bases and salts.

C. Course content in terms of specific objectives:

1. Preparation of standard solution of an acid and alkali
2. Determine the viscosity of a liquid by Red wood viscometer at different temperatures and plotting graph between viscosity and temperature.
3. To determine the partition coefficient of iodine between water and carbon tetrachloride.
4. To determine the partition coefficient of benzoic acid between water and benzene at room temperature and molecular state of Benzoic acid in benzene as compared to its solution in water.
5. To prepare colloidal solution of starch.
6. To prepare colloidal solution of egg albumin.
7. Determine the solubility of a given salt at room temperature and also draw its solubility curve.
8. To determine the adsorption isotherm of acetic acid by activated charcoal.
9. To investigate the adsorption of oxalic acid from aqueous solution of activated charcoal and examines the validity of Freundlich and Langmuir's adsorption isotherm.
10. To determine the rate constant for hydrolysis of ethyl acetate catalyzed by hydrochloric acid

Pr2. INTRODUCTION TO BIOTECHNOLOGY LAB

Name of the Course: Diploma in Biotechnology			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Lab. periods:	4P / week	Sessional:	25
Maximum marks:	50	End Semester Examination:	25

A. Rationale:

This course is designed to give students both a theoretical background and a working knowledge of the instrumentation and techniques employed in a biotechnology laboratory. Emphasis will be placed on the introduction of foreign DNA into bacterial cells, as well as the analysis of nucleic acids (DNA and RNA) and proteins.

B. Objective:

1. On completion of the lab course the student will be able to:
2. Explain the scientific basis for each technique used.
3. Amplify DNA using the polymerase chain reaction (PCR)
4. Practice critical thinking skills and apply them to both material presented in lecture and the analysis of data generated in the laboratory.
5. Operate the spectrophotometer.
6. Demonstrate different types of centrifuges.

C. Course content in terms of specific objectives:

1. Observe Basic instrumentation in biotechnology.

2 .To Conduct Protoplast isolation and fusion.

3. To Demonstrate Structure of DNA.

4. To Isolate DNA from Plant cell.

5. To Quantify DNA by using spectrophotometer.

6. Demonstrate PCR (Polymerase chain reaction).

7. Demonstrate Different types of Centrifugation.

8. To perform Cell immobilization by using sodium alginate and calcium chloride.

9. To Extract enzymes from milk.

10 .To analyze Enzyme kinetic of the given enzyme

Pr3.CELL AND MOLECULAR BIOLOGY LAB

Name of the Course: Diploma in Biotechnology			
Course code:		Semester	3rd
Total Period:	75	Examination	3 hrs
Lab. periods:	5P / week	Sessional:	50
Maximum marks:	100	End Semester Examination:	50

A. Rationale:

A deep and thorough understanding of biology requires knowledge of the structures and functions of cellular and molecular components of living cells. This class combines lectures and practical exercises to understand, explain, and analyze the basic function of cells, cellular components, energy metabolism, propagation of heritable material, and the regulation of gene expression. Students will be able to apply the principles that are learned in this course to enhance their understanding of other aspects of Biology such as evolution, ecology, and organismal physiology. The exercise sections will introduce the students to common techniques in molecular biology and allow them to gain handson experience in these techniques. The students will also be trained in how to formulate, conduct, and report scientific experiments.

B. Objective:

On completion of the lab course the student will be able to:

1. Learn how to operate the microscope to view slides.
2. Isolate plasmids from two different bacteria cultures and perform quantification and plasmid mapping on the product.
3. Learn the use of hemocytometer.

C. Course content in terms of specific objectives:

1. Slide identification of different cells
2. Separation of plant pigments by paper Chromatography
3. Identification of Meiosis in onion root tip.
4. Identification of Meiosis stages in onion root tip.
5. Preparation of blood smears.
6. Identify constituents of blood.
7. Isolation of genomic DNA from bacteria.
8. Isolation of plasmid DNA from bacteria.

Pr4. ENVIRONMENTAL ENGINEERING LABORATORY

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
Total Period:	45	Examination :	3hrs
Lab. periods:	3P / week	Sessional:	25
Maximum marks:	25	End Semester Examination ::	

A. Rationale:

Practicals are an integral part of understanding and learning a particular subject. For the course in Environmental Science, practicals include field studies, laboratory exercises (analysis), and creative activities. These exercises are not only relevant to get a better understanding of environment but also provide hands-on experience at devising methods for preventing environmental degradation.

B. Objective:

On completion of the lab course the student will be able to:

1. Find out the amount of dissolved oxygen in the given sample of water.
2. Determine Biological Oxygen Demand (BOD) of a given sample of water.
3. Find out the chemical oxygen demand (COD) of a water sample .
4. Determine the pH and Conductivity and turbidity of given water samples.
5. Determination of pH and conductivity of soil/ sludge samples.
6. Find out the total dissolved solid in the given water sample

C. Course content in terms of specific objectives:

1. Collection of sample of waste water .
2. Analyze a given sample of waste water for estimation of dissolved chloride .
3. Determine the dissolved oxygen content of water by Winkler's method .
4. Determine the chemical oxygen demand (BOD) exerted by a given sample of waste water.
5. Determine the chemical oxygen demand (COD) of a given sample of waste water` .
6. Determine the turbidity of a given sample of waste water .
7. Determine the total dissolved solid in a given sample of waste water .
8. Determine the optimum amount of Coagulant required to treat to turbid water .
9. Determine the amount of sulphate in a given sample of water.