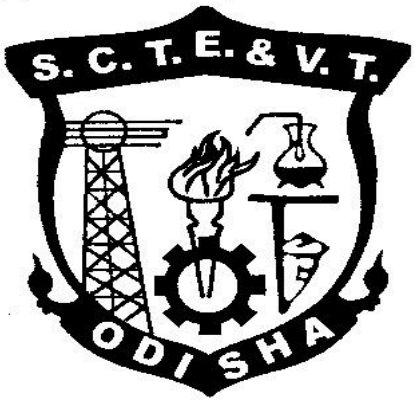
CURRICULLUM OF 5TH SEMESTER

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 5th 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		Entrepreneurship and Management & Smart Technology	4	-	-	20	80	3	100
Th.2		Genetic Engineering	4	-	-	20	80	3	100
Th.3		Plant Biotechnology	4	-	-	20	80	3	100
Th.4		Biochemistry	4	-	-	20	80	3	100
Th.5		Instrumentation & Chemical Analysis*	4	-		20	80	3	100
		Total	20		-	100	400	-	500
		Practical							
Pr.1		Instrumentation Laboratory*	-	-	3	25	25	3	50
Pr.2		Bio Chemistry Laboratory	-	-	6	50	50	3	100
Pr.3		Tissue Culture Laboratory			3	25	25	3	50
Pr.4		Project Phase-I	-	-	4	50	-	-	50
		Student Centred Activities(SCA)	-	-	3	-	-	-	-
		Total	-	-	*19*	*150*	*100*	-	*250*
		Grand Total	**20**	**0**	**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. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY

(Common to All Branches)

Theory	**4 Periods per week**	**Internal Assessment**	**20 Marks**
Total Periods	**60 Periods**	**End Sem Exam**	**80 Marks**
Examination	**3hours**	**Total Marks**	**100Marks**

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. **Entrepreneurship**
   - Concept /Meaning of Entrepreneurship
   - Need of Entrepreneurship
   - Characteristics, Qualities and Types of entrepreneur, Functions

- Barriers in entrepreneurship
- Entrepreneurs vrs. Manager
- Forms of Business Ownership: Sole proprietorship, partnership forms and others
- Types of Industries, Concept of Start-ups
- Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC,OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
- Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification (Business Planning)**

- Business Planning
- SSI, Ancillary Units, Tiny Units, Service sector Units
- Time schedule Plan, Agencies to be contacted for Project Implementation
- Assessment of Demand and supply and Potential areas of Growth
- Identifying Business Opportunity
- Final Product selection

3. **Project report Preparation**

- Preliminary project report
- Detailed project report, Techno economic Feasibility
- Project Viability

4. **Management Principles**
- Definitions of management
- Principles of management
- Functions of management (planning, organising, staffing, directing and controlling etc.)
- Level of Management in an Organisation

5. **Functional Areas of Management**

a) Production management
- Functions, Activities
- Productivity
- Quality control
- Production Planning and control

b) Inventory Management
- Need for Inventory management
- Models/Techniques of Inventory management

c) Financial Management
- Functions of Financial management
- Management of Working capital
- Costing (only concept)
- Break even Analysis
- Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)

d) Marketing Management
- Concept of Marketing and Marketing Management
- Marketing Techniques (only concepts)
- Concept of 4P s (Price, Place, Product, Promotion)

e) Human Resource Management
- Functions of Personnel Management

- Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages

6. **Leadership and Motivation**

a) Leadership
- Definition and Need/Importance
- Qualities and functions of a leader
- Manager Vs Leader
- Style of Leadership (Autocratic, Democratic, Participative)

b) Motivation
- Definition and characteristics
- Importance of motivation
- Factors affecting motivation
- Theories of motivation (Maslow)
- Methods of Improving Motivation
- Importance of Communication in Business
- Types and Barriers of Communication

7. **Work Culture, TQM & Safety**

- Human relationship and Performance in Organization
- Relations with Peers, Superiors and Subordinates
- TQM concepts: Quality Policy, Quality Management, Quality system
- Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)

8. **Legislation**

a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
b) Features of Factories Act 1948 with Amendment (only salient points)
c) Features of Payment of Wages Act 1936 (only salient points)

9. **Smart Technology**
- Concept of IOT, How IOT works
- Components of IOT, Characteristics of IOT, Categories of IOT
- Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. https://www.fundable.com/learn/resources/guides/startup

Th. 2 GENETIC ENGINEERING

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	5th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. **Rationale**:

Genetic engineering, also called genetic modification or genetic manipulation, is the direct manipulation of an organism's genes using biotechnology. It is a set of technologies used to change the genetic makeup of cells, including the transfer of genes within and across species boundaries to produce improved or novel organisms. New DNA is obtained by either isolating and copying the genetic material of interest using recombinant DNA methods or by artificially synthesising the DNA. Genetic engineering has been applied in numerous fields including research, medicine, industrial biotechnology and agriculture. By knocking out genes responsible for certain conditions it is possible to create animal model organisms of human diseases. As well as producing hormones, vaccines and other drugs. Genetic engineering has the potential to cure genetic diseases through gene therapy. The same techniques that are used to produce drugs can also have industrial applications such as producing enzymes for laundry detergent, cheeses and other products.

Objective:

After completion of the study of the concepts of genetic engineering and genetics the student will be able to:

1. Know the genetics infrastructure and its relation with heredity.
2. Know about the latest technologies like Recombinant DNA technology, cleaning
3. Know about the latest researches and discoveries related to genetic engineering and their application in different fields.
4. Know about the remedies in the gene through gene manipulation.

C.	**Topic Wise Distribution of Periods**	
SL. No.	Topics	Period
1	Recombinant DNA Technology	15
2	Vector Systems	15
3	Construction & Cloning of rDNA	10
4	Screening Technique	10
5	Study of Genetic Engineering Technology	10
	Total	60

Chapter 1. RECOMBINANT DNA TECHNOLOY

1.1 Concept of Genetic Engineering.
1.2 rDNA technology, Basic steps of rDNA
1.3 Tools of rDNA
1.4 Discussion about Restriction Endo nuclease enzyme.
1.5 DNA modifying enzymes and necessary role of rDNA

Chapter 2. VECTOR SYSTEMS

2.1 Gene cloning Vectors.
2.2 Plasmids and their properties.
2.3 Bacteriophage vectors for E. coli.
2.4 Life cycle of M13 and lambda phage in E. coli.
2.6 Cosmids, Shuttle Vectors, YAC vectors.

Chapter 3. CONSTRUCTION & CLONING of rDNA

3.1 Integration of DNA insert in to vector.
3.2 Linkers, adaptors and Homo polymer tailing.
3.3 cDNA and Genomic Libraries.
3.4 Introduction of foreign DNA into host cells.
3.5 Transformation- Griffith Effect, Infection, Transfection.

Chapter 4. SCREENING TECHNIQUE

4.1 Sequence based screening – colony hybridization
4.2 Chromosome walking
4.3 Concept of chromosome Jumping, Screening by PCR, Gene Tagging.

Chapter 5.STUDY OF GENETIC ENGINEERING TECHNOLOGY

5.1 Blotting Techniques (Southern & Western blotting).
5.2 Genetic finger printing.
5.3 Microarray Technology.
5.4 Different molecular genetic marker RFLP,RAPD only

Syllabus Coverage up to I.A

Chapter 1,2,3

Books Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	L M Narayanan	Genetic Engineering	Saras Publication
2	P S Verma	Genetic Engineering	S Chand
3	Sandhya Mitra	Genetic Engineering	Tata Mc Grawhill
4	Desmond S T Nicholl	An Introduction to Genetic Engineering	Cambridge University Press

Th. 3 PLANT BIOTECHNOLOGY

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	5th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. **Rationale**:

Plant biotechnology has emerged as an exciting area of plant sciences in the past decade. Availability of an efficient transformation system using *Agrobactorium*and case of regeneration of plants from transformed tissues by virtue of the potency of plant cells have lead to remarkable progress in the area of plant genetic engineering and tissue culture. Research using transgenic plants has provided an unique opportunity for understanding and testing basic concepts in many areas, such as protein targeting to organelles, genome organisation, developmental regulation of gene expression and transposition of eukaryotic transposable elements.

OBJECTIVES:

After completion of Plant Biotechnology the student will be able to

1. Understand the principle of plant biotechnology.
2. Describe the process involved and outlines of manufacturing of some tissue culture products in daily life.

C. Topic Wise Distribution of Periods

SL. No.	Topics	Period
1	Introduction to Plant Biotechnology	15
2	Plant Tissue Culture	20
3	Plant transformation Technology	15
4	Application of Transgenic Plant	10
	Total	**60**

Chapter 1. INTRODUCTION TO PLANT BIOTECHNOLOGY

1.1 Concept of Plant Biotechnology.
1.2 Tissue culture laboratory (Equipments, glass wares & chemicals).
1.3 Sterilization & Aseptic condition
1.4 Applications of plant tissue culture.

Chapter 2. PLANT TISSUE CULTURE

2.1 culture media
2.2 Callus & Different culture techniques.
2.3 Protoplast: Isolation, fusion & culture
2.4 Somatic Embryogenesis.
2.5 Single cell culture.
2.6 Embryo culture
2.7 Somatic hybridization and Cybridization.

Chapter 3.0 PLANT TRANSFORMATION TECHNOLOGY

3.1 Vector mediated Gene gene transfer
3.2 Agro bacterium mediated gene transfer methods
2.3 Ti-plasmid &Ri plasmid
3.4 Formation of transgenic plant
3.5 Transposon & Transposable elements .

Chapter 4.0 APPLICATION OF TRANSGENIC PLANT

4.1 Flavor ,Savor (tomato)
4.2 BT cotton
4.3 BT Brinjal
4.4 Gloden Rice

Syllabus Coverage up to I.A

Chapter 1,2,3

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	B D Singh	Plant Biotechnology	Kalyani Publication
2	H S Chawla	Introduction to Plant Biotechnology	Oxford IBH Publication
3	Slater	Plant Biotechnology	Oxford Publication

Th. 4 BIOCHEMISTRY

Name of the Course: Diploma in Biotechnology			
Course Code		Semester	5th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Maximum Marks:	100	End Semester Examination Marks	80

A. Rationale:

Biochemistry is the branch of science that explores the chemical processes within and related to living organisms. It is a laboratory based science that brings together biology and chemistry. By using chemical knowledge and techniques, Biotechnologist can understand and solve biological problems. Biochemistry is both life science and a chemical science - it explores the chemistry of living organisms and the molecular basis for the changes occurring in living cells to determine how specific molecules such as proteins, nucleic acids, lipids, vitamins, and hormones function in such processes. Knowledge of Biochemistry is vital for Biotechnologist to understand mechanism of Chemical reactions in living organism.

B. Objective :

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

1. Know chemical nature and behaviour of the cell and the organism related to it.
2. Know the different bio molecules that are the components of a cell and their effect on the existence and functioning of cell.
3. Know about the structure and functions of carbohydrates, lipids, nucleic acids and proteins in cell organisation and their role in regulation of different cellular processes.
4. Know about the intracellular and intercellular transport of signals, nutrition etc. due to different cellular processes.

C. Topic Wise Distribution of Periods

Sl. No.	Topics	Period
1	Carbohydrates	10
2	Amino acids, Peptides and proteins	15
3	Nucleotides and Nucleic Acid	15
4	Lipids and Fats	10
5	Lipid Bilayer	10
	Total	60

COURSE CONTENT

Chapter 1. CARBOHYDRATES

1.1 Structure and function of monosaccharides, disaccharides and polysaccharides.
1.2 Proteoglycans
1.3 Glycoprotein with glycolipids
1.4 Some commercially important carbohydrates.

Chapter 2. AMINO ACIDS, PEPTIDES AND PROTEINS

2.1 Structure and function of amino acids.
2.2 Classification of amino acids, according to their functional group
2.3 Biological activity of small peptides

2.4 Biosynthesis of amino acids
2.5 Structure and function of protein
2.6 Different types of protein with respect to their structure and function

Chapter 3. NUCLEOTIDES AND NUCLEIC ACID

3.1 Structure and function of nucleotides
3.2 Properties of nucleotide bases that affect the structure of nucleic acid
3.3 Chemistry of nucleic acid
3.4 Structure of nucleic acid

Chapter 4. LIPIDS AND FATS

4.1 Storagelipids.
4.2 Structurallipids.
4.3 Lipids with specific biological activities.

Chapter 5. LIPID BILAYER

5.1Amphipathicnature of membrane lipids that form the bilayer.
5.2 Role of lipid in plasma membrane.

Syllabus Coverage up to I.A

Chapter 1,2,3,4

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	C.K. Mathews	Biochemistry	Pearson
2	Lehinger	Lehninger's principles of Biochemistry	Nelson & Cox
3	Jain &Jain	Fundamentals of Biochemistry	S Chand
4	Voet &Voet	Biochemistry	John Wiley

Th.5 Instrumentation & Chemical Analysis

(Common to Chemical Engineering, Biotechnology & Food Technology)

Theory:4 Periods per Week	Internal Assessment: 20 Marks
Total periods:60 Periods	Term End Examination: 80 Marks
Examination: 3 Hours	Total Marks: 100 Marks

A. Rationale:

Number of control equipment and measuring devices are used in the operation of equipment to control of process variable, these variables like temperature, pressure, level, viscosity, density, refractive index etc. affect the processing equipment and ultimately affect the product quality. It is necessary to study the principle of operation of process variables measuring devices, so that they may be used either on-line or off line for this purpose.

B. **Objectives :**

After completion of study of Instrumentation and chemical Analysis the student will be able to :

1. Understand working principle, construction, repair and maintenance of measuring instrument and their used to control chemical engineering unit operations and processes.
2. Operate modern analytical instruments for measuring process parameters

TOPIC WISE DISTRIBUTION OF PERIODS

SL. No.	Topic	Periods
1	Instrument	05
2	Measurement of characteristics	10
3	pH & conductivity measurement	05
4	Temperature measurement	10
5	Pressure measurement	10
6	Automatic control	20
	Total	**60**

Chapter 1.0 INSTRUMENT

1.1 Instruments and its importance
1.2 Standards of measurement
1.3 Functional elements of instruments
1.4 Performance characteristics of an instrument

Chapter 2.0 MEASUREMENTS OF CHARACTERISTICS

2.1 Measurement of viscosity by Red Wood Viscometer, Falling Sphere Viscometer, Continuous Viscometer
2.2 Principle and uses of spectrophotometer
2.3 Principle and uses of polarimeter
2.4 Measurement of refractive index by Refractometer

Chapter 3.0 pH & CONDUCTIVITY MEASUREMENT

3.1 Measurement of pH
3.2 Measurement of electrical conductivity

Chapter 4.0 TEMPERATURE MEASURMENT

4.1 Different temperature scales.
4.2 Different methods of temperature measurement.
4.3 Temperature measurement by liquid in glass thermometer
4.4 Describe temperature measurement on electrical phenomena – like thermocouple, resistance thermometer, optical pyrometer, radiation pyrometer.

Chapter 5.0 PRESSURE MEASUREMENT

5.1 Different types of pressure
5.2 Different methods of measurement of pressure.
5.3 Pressure measurement by Bourdon tube, Bellows
5.4 Maintenance and repair of pressure measuring instruments.

Chapter 6.0 AUTOMATIC CONTROL

6.1 Automatic control system and explain the application with example.
6.2 Elementary idea about transfer functions for a first order system and time constant.
6.3 Block diagram and components of Process Control system
6.4 Types of process control system, advantages and disadvantages
6.3 Elementary idea about different types of automatic controllers.
6.4 Principle of PLC, computer Aided measurement and control

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

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	D.P. Eckman	Industrial Instrumentation	CBS Publication
2	S.K. Singh	Industrial Instrumentation and control	Tata Mc Grawhill
3	A.K. Srivastava	Instrumental Approach to Chemical Analysis	S Chand

Pr.1 INSTRUMENTATION LABORATORY

Common to Chemical, Biotechnology & Food Technology

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

A. Rationale:

An instrument is a device that measures or manipulates process physical variables such as flow, temperature, level, or pressure etc. Instrumentation is the basic process control in industry. In industrial control a wide number of variables temperature, flow, level, pressure, and distance can be sensed simultaneously. Structure of Industrial Instrumentation in Real Time Applications includes for measuring, regulating physical quantities such as flow, level, pressure, temperature and so on. Output instrumentation includes control devices such as valves, regulators, circuit breakers and relays.

Students will gain skill to handle, measure and care of different instruments used in the process industry.

B. **Objectives :**

After completion of study of Instrumentation and Process Control the student will be able to :

1. Understand working principle, construction, repair and maintenance of pH Meter, Polari meter, Refracto meter, Viscometer used in industry
2. Understand the principle of measuring instruments.

List of EXPERIMENTs

SL. No.	Experiment
1	Separation of Iron using solvent extraction technique
2	Determine pH and conductivity of a given solution by pH-meter
3	Determine the concentration of sugar in sugar solution by Polarimeter
4	Determine the refractive index of different liquids by Abbe's Refractometer
5	To determine a) Maximum wavelength of a solution of cobalt chloride b) Verify Beer's Law and apply it to find the concentration of the given unknown solution by Spectrophotometer
6	To verify Beer's law of solution of $KMnO_4$ and $K_2Cr_2O_7$ using calorimeter
7	Demonstrate different types of pressure gauges and temperature measuring devices
8	Determine the viscosity of an Oil by Red Wood Viscometer at different temperature and plotting a graph between viscosity and temperature
9	Calibration of a thermocouple
10	Demonstrate function of digital multi-meter

Pr.2 BIOCHEMISTRY LABORATORY

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

A. Rationale:

Biochemists mainly study the structures and functions of enzymes, proteins, carbohydrates, fats, process of metabolism and the molecular basis of the action of genes. As a field Biochemistry has seen unprecedented growth because of its significant contribution towards the illumination and grasping of the DNA Structure. A biochemist has the skills to work in the field of medical, agriculture, public health care, forensic environment.

B. **Objectives :**
After completion of Practical of Biochemistry, the student will be able to :

1. Understand protocol, techniques of qualitative analysis of constituents
2. Determine the quantitative value of constituents.

List of Experiments

Sl. No	Name of Experiment
1	Determination of pH color comparison pH meter determination of PKa value
2	Qualitative tests on carbohydrates and proteins.
3	Estimation of total sugar by anthrone method
4	Estimation of reducing sugar by Benedict's test.
5	To perform the fatty acid titration.
6	Verification of Beer Lambert's law .
7	To determine iodine value of different fat samples.
8	To quantify amino acid using ninhydrin reaction.

Pr.-3 TISSUE CULTURE LABORATORY

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

C. Rationale:

Plant tissue culture is a collection of techniques used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of known composition. It is widely used to produce clones of a plant in a method known as micro propagation.

D. **Objectives :**

After completion of Practical of Plant Tissue Culture, the student will be able to :

3. Understand protocol, techniques, working, and operation of tissue culture
4. Prepare tissue culture products independently in laboratory.

Experiment Wise Distribution of Periods

List of experiments

Sr No	Name Of Experiment	No of Periods
1	Sterilization(glass wares & equipments) i) Dry heat sterilization ii) Steam sterilization iii) Flame sterilization iv) Filter sterilization	10
2	Preparation of different culture media.	10
3	Learning Inoculation procedures	10
4	Callus & cell suspension culture	15

Pr 4. PROJECT WORK (Phase-I)

Name of the Course: Diploma in Bio Tech.			
Course code:		Semester	5th
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	50
		TOTAL Marks	50

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 Bio Technology and practices in real life situations, so as to participate and manage a Bio Tech. Project in future.

Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be 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 software/hardware design.
- To develop the skill of writing Project Report

General Guidelines

The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of

the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. Preferably there should not be more than 5 students, if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Processes based Project: Manufacture of product.
- ✓ Equipment based Project: Detailed design and fabrication of the equipment for a given capacity.
- ✓ Experimental based Project: Experimental investigation of basic or applied research problem.
- ✓ Industrial Problems: Any problem or project directly related to existing plants for modification of process or equipment or regarding pollution control and energy conservation under the guidance of a staff member and /or staff members and submit a typed report in duplicate.
- ✓ Research Oriented: Any application/renovation/modification of a latest technology

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.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters(5^{th} and 6^{th} sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5^{th} sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work including Design of the system have to be complete in Phase-I. Project Milestones are to be set so that progress can be tracked . In Phase-II Work execution, Simulation, Testing, Documentation 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-I in 5^{th} semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

LIST OF EQUIPMENTS

INSTRUMENTATION LABORATORY		
Sr	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	Tripod stand	02 no
7	Mortar and pestle	01 no
8	Beaker-250 ml and 500 ml	05 no
9	Pipette- 10 ml, 25 ml	05 no
10	Measuring cylinder-10 ml,50 ml,100 ml	01each
11	Provision of LPG gas heating facility	02 no
12	Separating funnel-500 ml	02 no
13	Digital pH meter	01 no
14	Polarimeter	01 no
15	Refractometer	01 no
16	Laboratory model spectrophotometer	01 no
17	Calorimeter	01 no
18	Different types of pressure gauges, temperature gauge	01 no
19	All small glass ware like glass rod, spatula, watch glass, test tube, test tube holder, dropping bottle etc as per experiment requirement	As per need
20	Digital multimeter	01 no
21	Thermocouple calibration set up	01 no

BIOCHEMISTRY LABORATORY		
Sr	Name of equipment with specification	Quantity per student strength up to 30
1	Digital pH Meter, PH & ORP, 31/2 Digit LED, + 0.01 pH, + 1mV	01 no
2	Spectrophotomete,190 to 1100 nm, Single monochromator, Double beam type	01 no
3	Digital Weighing Machine, Upto 500gm Accuracy: 0.001gm	02 no
4	Vortex Mixture , Dimensions (W x D x H) 5.5 x 6.3 x 5.1 in/14 x 16 x 13 cm Weight 4.84 lb/2.2 kg Electrical 230V~, 50 Hz or 120V~, 60 Hz	02 no
5	Conical flask,100ml, 250ml,500 ml	10 no
6	Glassware- as per requirement	02 set

TISSUE CULTURE LABORATORY		
Sr	Name of equipment with specification	Quantity per student strength up to 30
1	Horizontal laminar Flow Chamber SS 304, 316 GI 220 VOLT sliding type	01 no
2	Vertical laminar Flow Chamber 4ft*2ft*6inch, manual sliding type,1 or 2 LEDlight,220volts/50Hz	02 no
3	Autoclave , Vertical ,SS type	03 no

4	Bacteriological Incubator Gravity Convection , thermostatic, Anhydric atmosphere, For use on 220/230 volts 50 cycles single phase AC only.	01 no
5	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	01 no
6	Distillation Unit Quartz / Silica Glass Single Distillation Unit Output 1.5Litre/Hr, 3.5Litre/Hr Electric supply 220/230v ac, 50/ 60hz	01 no
7	Water bath Cum Shaker 275 x 275 x 150mm 12 Ltr.	01 no
8	Tissue culture rack , 48"x 12" , Mild steel 4 shelves Distance between each rack 15" 3mm thickness	01 no