

**STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES**

DISCIPLINE: BIO-TECHNOLOGY						SEMESTER: 6TH						
SL NO	SUBJECT CODE	SUBJECT	PERIODS			EVALUATION SCHEME						
			L	T	P	INTERNAL EXAM			END SEM EXAM	TERM WORK	PRACTICAL EXAM	TOTAL MARKS
						TA	CT	Total				
THEORY												
1.	BST 501 OR HMT 601	Environmental Studies OR Entrepreneurship & Management	5	0	-	10	20	30	70			100
2.	BTT 601	Instrumentation & Process Control	4	0	-	10	20	30	70			100
3.	BTT 602	Downstream processing	4	0	-	10	20	30	70			100
4.	BTT 603	Bioprocess Engineering	4	0	-	10	20	30	70			100
5.	BTT 604	Elective (ANY ONE)	4	0	-	10	20	30	70			100
	i	Industrial Biotechnology										
	ii	Bioinformatics										
	iii	Pharmaceutical Biotechnology										
	iv	Food Biotechnology										
PRACTICAL/TERM WORK												
6.	BTP 601	Instrumentation Laboratory	0	0	4					25	25	50
7.	BTP 602	Downstream Processing Laboratory	0	0	4					25	25	50
8.	BTP 603	Bioprocess Engineering Laboratory	0	0	4					25	25	50
9.	BTP 604	Project Work-2	0	0	6					50	50	100
GRAND TOTAL			21	0	18	50	100	150	350	125	125	750
Total Contact hours per week: 39 Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assignment, CT- Class test Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%												

ENVIRONMENTAL STUDIES

BST-501

Period/Week: 05

Total Marks: 100

Total Periods: 75

Theory End Exams: 70; CT (20) +IA (10)

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 Engineering student in order to take care of the environmental aspect in each and every activity in the best possible manner.

OBJECTIVES:

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.

Unit 1: The Multidisciplinary nature of environmental studies (04 periods)

Definition, scope and importance, Need for public awareness.

Unit 2: Natural Resources (12 periods)

Renewable and non renewable resources:

- a) Natural resources and associated problems.
 - Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.
 - Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.
 - Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.
 - Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, .

- Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
 - Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.
- b) Role of individual in conservation of natural resources.
- c) Equitable use of resources for sustainable life styles.

Unit 3: Systems

(12 periods)

- Concept of an eco system.
- Structure and function of an eco system.
- Producers, consumers, decomposers.
- Energy flow in the eco systems.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following eco system:
- Forest ecosystem:
- Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4: Biodiversity and it's Conservation

(08 periods)

- Introduction-Definition: genetics, species and ecosystem diversity.
- Biogeographically classification of India.
- Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optin values.
- Biodiversity at global, national and local level.
- Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

Unit 5: Environmental Pollution.

(18 periods)

Definition Causes, effects and control measures of:

- a) Air pollution.
- b) Water pollution.
- c) Soil pollution
- d) Marine pollution
- e) Noise pollution.
- f) Thermal pollution
- g) Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Disaster management: Floods, earth quake, cyclone and landslides.

Unit 6: Social issues and the Environment

(12 periods)

- Form unsustainable to sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, water shed management.
- Resettlement and rehabilitation of people; its problems and concern.
- Environmental ethics: issue and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
- Air (prevention and control of pollution) Act.
- Water (prevention and control of pollution) Act.
- Public awareness.
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Unit 7: Human population and the environment

(09 periods)

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

Recommended Books:

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 by K.Raghavan Nambiar, SCITECH Publication Pvt. Ltd.
4. Environmental Engineering by V.M.Domkundwar- Dhanpat Rai & Co.
5. Environmental Engineering & Safety by B.K.Mohapatra.

ENTREPRENEURSHIP & MANAGEMENT

(Code : HMT-601)

Period/Week: 05

Total Marks: 100

Total Periods: 75

Theory End Exams: 70; CT (20) +IA (10)

(COMMON TO ALL BRANCHES OF ENGG EXCEPT CIVIL/ CSE/ IT)

OBJECTIVES:

On completion of the course, students will be able to :

1. Understand the concept of different forms of organization including MSME and various managerial functions.
2. Understand Entrepreneurship and choose it as a career option after study.
3. Learn about the basic financial accounting and cost control.
4. Know different areas of management relating to stores and purchase, finance, production, sales and marketing and human resources in an organization.
5. Learn about various reasons of industrial sickness and its remedial measures.
6. Have a comprehensive idea on important legislations relating to employment in Factory.

SYLLABUS

- 1. Concept of Organization & Enterprise Management: 12 periods**
 - 1.1. Meaning, features and components of Business
 - 1.2. Different forms of Business Organizations with features
 - 1.3. Meaning, definitions and importance of management
 - 1.4. Difference between Management & Administration
 - 1.5. Functions of management- Planning, Organizing, Staffing, Directing (including Motivation, Leadership & Communication), Coordinating and Controlling.
 - 1.6. Principles of Scientific Management.
- 2. Entrepreneurship & Management of MSME: 12 periods**
 - 2.1. Meaning & Need of Entrepreneurship
 - 2.2. Qualities of an Entrepreneur
 - 2.3. Relevance of Entrepreneurship of Socio-economic gain
(Generating national wealth, creating wage & self employment, developing MSME enterprises, Optimizing human and national resources, building enterprising personalities and society)
 - 2.4. Micro, Small and Medium Enterprises. (investment limits of MSME)
 - 2.5. Project Report- PPR & DPR. (Preparation of a PPR)

- 2.6. Incentives available to MSME as per the latest IPR
 - 2.7. Role of DIC, OSFC, OSIC, IDCO, SIDBI, IPICOL and Commercial Banks in the context of MSME.
3. **Financial Accounting & Cost Control:** **12 periods**
- 3.1. Double- entry System of Book –keeping and types of accounts
 - 3.2. Journal, Ledger, Cash Book (different types), Trial balance
 - 3.3. Components of Final Accounts- Trading A/c, Profit & Loss A/c and Balance Sheet
 - 3.4. Elements of Cost and Preparation of Cost Sheet
 - 3.5. Break-even Analysis
4. **Financial Management:** **04 periods**
- 4.1. Meaning & Importance
 - 4.2. Finance Functions
 - 4.3. Types of Capital- Fixed & Working Capital
 - 4.4. Components of Working Capital, Working Capital Cycle
5. **Stores & Purchase Management:** **05 periods**
- 5.1. Inventory Control : Importance & Techniques
 - 5.2. Purchase management-Principles & Procedures
 - 5.3. Important Store Records (Bin Card, Stores Ledger & GRN)
6. **Production Management:** **04 periods**
- 6.1. Production & Productivity
 - 6.2. Production , Planning & Control- (meaning & steps)
7. **Sales & Marketing Management:** **08 periods**
- 7.1. Sales & Marketing Management- Meaning & Importance
 - 7.2. Selling Methods
 - 7.3. Product Policy- (Branding, Packaging, Labeling)
 - 7.4. Product-mix, Pricing methods and Sales Promotion including its techniques.
 - 7.5. Advertising & its media
8. **Human Resource Management:** **06 periods**
- 8.1. Need & Importance
 - 8.2. Recruitment & its sources
 - 8.3. Selection- Methods
 - 8.4. Training- Need, & Methods
 - 8.5. Need of Performance Appraisal

9. Industrial Sickness:

04 periods

- 9.1. Meaning & Symptoms of Sickness
- 9.2. Causes of Industrial Sickness
- 9.3. Remedial measures of Sickness

10. Industrial Legislation:

08 periods

- 10.1. Major Provisions of Factories Act relating to Health, Welfare, Safety, Accidents, Hours of Work, employment of Women
- 10.2. Duties and Power of Factory Inspector
- 10.3. Major Provisions of Employee's Compensation Act.

Books Recommended

1. Industrial Engineering & Management : O.P.Khanna
2. Entrepreneurship for Engineers : B.Badhai
3. Principles & Practice of Management : L.M.Prasad
4. Industrial Engineering & Management: Banga & Sharma
5. Mercantile Law: N.D.Kapoor
6. Industrial Engineering & production Management: M.Mahajan
7. Industrial Policy Resolution (latest)

INSTRUMENTATION AND PROCESS CONTROL

L 4	T 0	P 0		BTT 601
Total Contact hours : 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks : 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

Rationale:

Number of control equipment and measuring devices are used in the operation of biochemical engineering unit operation equipment to control of process variables, 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.

Objective:

After completion of study of Instrumentation and Process Control, the student will be able to understand working principle, construction, repair and maintenance of measuring instrument and their used to control chemical engineering unit operations and processes.

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Basic Concepts on Measurement & Optical Level measuring Instruments	08
2.	Pressure and Temperature measurement	12
3.	Density and PH measurement	05
4.	Industrial Control System	05
5.	Spectroscopy	10
6.	Chromatography	10
7.	Electrophoresis	10
	Total	60

1.0 BASIC CONCEPTS ON MEASUREMENT & OPTICAL MEASURING INSTRUMENTS

- 1.1 Instrumentation, measurement and its aim.
- 1.2 Functional elements of an instrument.
- 1.3 Performance characteristic and error in an instrument.
- 1.4 The selection of instrument.
- 1.5 The troubleshooting and maintenance of equipment.
- 1.6 Optical and level Measuring Instruments.
- 1.7 Function and construction microscope & describe its magnification.
- 1.8 Explain the types of microscope (simple microscope, compound microscope & stereoscopic)

2.0 PRESSURE AND TEMPERATURE MEASUREMENT

- 2.1 Different types of pressure and its unit.
- 2.2 Methods of pressure Measurement.
(Manometer method, Elastic pressure transducers, Pressure measurement by measuring vacuum, electrical pressure transducers)
- 2.3 Functions of different types of manometer and errors in it.
- 2.4 Different types of elastic pressure transducers.
(C- Type Bourdon tube Pressure gauge, Diaphragm, Bellows)
- 2.5 Different type of measurement of vacuum.
(Capsule gauge, McLeod gauge, thermal conductivity gauge, Ionization gauge)
- 2.6 Maintenance and repair of pressure measuring instruments.
- 2.7 Different temperature scale.
(Fahrenheit, centigrade, Kelvin, Rankin and Reaumur scale)
- 2.8 Methods of temperature Measurement
(Expansion thermometers, Filled system thermometer, electrical temperature instruments, pyrometer)
- 2.9 Types of expansion thermometer with their construction and working
 - a) (Expansion of solids –eg Bimetallic thermometer, expansion of liquids – liquid in glass thermometer, liquid on metal thermometer, Expansion of gases, gas thermometer)
 - b) Explain the types of electrical temperature instruments
(Resistance thermometer, thermocouple, thermometer)
 - c) The calibration of thermometer.

3.0 DENSITY AND P^H MEASUREMENT

- 3.1 Different methods of expressing densities.
- 3.2 Type of density measurements and their principle
(Solid, liquid and gas density measurement.)
- 3.3 Working of hydrometers.
- 3.4 Principle, construction and the working of a pH meter.
- 3.5 Application of pH meter in industry.

4.0 INDUSTRIAL CONTROL SYSTEM

- 4.1 Illustrate examples of process control system.
- 4.2 Block diagram representation of process control systems.
- 4.3 Components of a process control system.
- 4.4 Elementary ideas about different types of process control systems.
- 4.5 Classify and explain industrial automatic controller (only elementary ideas)

5.0 SPECTROSCOPY

- 5.1 Molecular spectroscopy
- 5.2 Wave parameters and energy of electromagnetic radiation.
- 5.3 Subdivide regions of electromagnetic spectrum
- 5.4 Molecular spectra.
- 5.5 Absorption laws.
- 5.6 Outline the instrumentation for VV visible spectroscopy.
- 5.7 Construction and operation of single and double beam spectrophotometer.

6.0 CHROMATOGRAPHY

- 6.1 Classify chromatography
- 6.2 Principle and application of paper chromatography.
- 6.3 Compare the superiority of TLC over other chromatographic method.
- 6.4 Experimental technique of thin layer chromatography.
- 6.5 Principle of gas chromatographic separations.

7.0 ELECTROPHORESIS

- 7.1 Explain electrophoresis.
- 7.2 Factors affecting electrophoresis mobility.
- 7.3 Types of electrophoresis. (Free electrophoresis, zone electrophoresis)
- 7.4 Techniques of zone electrophoresis.
(Paper electrophoresis, cellulose acetate electrophoresis, gel electrophoresis).
- 7.5 Model of gel electrophoresis with instruments.
- 7.6 Applications of gel electrophoresis.

REFERENCE BOOKS

1. S.K. Singh 'Industrial instrumentation and control'
2. S. Usharani 'Analytical Chemistry'
3. G. Chatwal, S.Anand 'Instrumental method of Chemical analysis'
4. Upadhyaya and Upadhyaya "Principles of Biophysical Chemistry"

DOWNSTREAM PROCESSING

L 4	T 0	P 0		BTT 602
Total Contact hours: 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks: 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

Rationale :

Downstream processing is the process of recovery and purification of biosynthetic products, particularly pharmaceuticals, from natural sources such as animal or plant tissue or fermentation broth. It is an essential step in the manufacture of pharmaceuticals such as antibiotics, hormones, antibodies and industrial enzyme. Downstream processing is usually considered a specialized field in biochemical engineering developed by chemists and biologists for laboratory-scale separation of biological products. It is very important for the biotechnologists to know basic points to be considered for large scale isolation, purification and characterization of bio product by using various unit operations and chromatographic methods.

Objectives :

1. Introduction to downstream processing, its scope and its applications in product isolation, characterization and purification on large scale, economics of downstream processing.
2. Physiochemical basis of Bio separation for macromolecules like DNA, Proteins, etc of commercial interest.
3. Role of important unit operations like centrifugation, filtration, precipitation/ extraction, downstream prospective.
4. Characterization and purification of final products (protein based) by various chromatographic methods

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Introduction	10
2.	Primary separation process	10
3.	Product isolation	10
4.	Chromatography	10
5.	Electrophoresis	10
6.	Product purification	10
	Total	60

1.0 INTRODUCTION

- 1.1 Downstream processing.
- 1.2 Bioprocess flow sheet.
- 1.3 Characteristics of bimolecular.
- 1.4 Various downstream process steps.

2.0 PRIMARY SEPARATION PROCESS

- 2.1 Principal for obtaining product from cell culture – intracellular & extracellular product.
- 2.2 Characteristics of byproducts.
- 2.3 Conditioning of broth.
- 2.4 Cell disruption – mechanical ,enzymatic & chemical methods
- 2.5 Solid liquid separation – Filtration and Centrifugation.

3.0 PRODUCT ISOLATION

- 1.1 Adsorption –Desorption process.
- 1.2 Liquid -liquid extraction.
- 1.3 Membrane separation – ultra filtration, microfiltration. Reverse osmosis, dialysis, and electro dialysis.
- 1.4 Precipitation of proteins by different methods.

4.0 CHROMOTAGRAPHY

- 4.1 Chromatographic method of separation based on size, charge, hydrophobic interaction & biological affinity.
- 4.2 Concept of HPLC,FPLC
- 4.3 Concept of MS-LC
- 4.4 Concept of Gas chromatography

5.0 ELECTROPHORESIS

- 5.1 Principle of electrophoresis.
- 5.2 Types of basic support media.
- 5.3 1D,2D gel electrophoresis.
- 5.4 Continuous & capillary electrophoresis.

6.0 PRODUCT PURIFICATION

- 6.1 Concept of Crystallization
- 6.2 Elementary idea of Distillation
- 6.3 Concept of Drying
- 6.4 Concept of Lyophilisation
- 6.5 Concept of Stabilization of byproducts

BOOKS :

1. Bioseparations: Principles and Techniques by Sivasankar B
2. Biophysical Chemistry Principles and techniques by Upadhyay, Upadhyay, and Nath

BIOPROCESS ENGINEERING

L 4	T 0	P 0		BTT 603
Total Contact hours. : 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks : 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

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.

Objectives :

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

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Principle of enzyme catalysis	05
2.	Microbial growth	05
3.	Introduction to bioprocess technology	10
4.	Process technology for production of primary metabolites	10
5.	Microbial production of industrial enzymes	10
6.	Production of secondary metabolites	10
7.	Industrial process and process economics	10
Total		60

1.0 PRINCIPLES OF ENZYME CATALYSIS

- 1.1 Proteins as enzymes.
- 1.2 Michaelis- Menten kinetics: Kinetics, Statistics and inhibition.
- 1.3 Effect of P^H & temp.
- 1.4 Immobilized enzymes & methods.
- 1.5 Industrial enzyme.

2.0 MICROBIAL GROWTH

- 2.1 Microbial growth kinetics.
- 2.2 Factors affecting microbial growth
- 2.3 Mass balance & energy balance
- 2.4 Measurement of growth.

3.0 INTRODUCTION TO BIOPROCESS TECHNOLOGY

- 3.1 Substrates for bioconversion process.
- 3.2 Design of media.
- 3.3 Sterilization.
- 3.4 Cell culture techniques.
- 3.5 Bio reactors – Type & designs

4.0 PROCESS TECHNOLOGY FOR PRODUCTION OF PRIMARY METABOLITE

- 4.1 Production of Baker's yeast.
- 4.2 Production of ethanol.
- 4.3 Production of citric acid.
- 4.4 Production of amino acid (lysine and glutamic acid)

5.0 MICROBIAL PRODUCTION OF INDUSTRIAL ENZYMES

- 5.1 Production of glucose isomerases.
- 5.2 Production of amylase.
- 5.3 Production of cellulose.
- 5.4 Production of lipase
- 5.5 Production of protease.

6.0 PRODUCTION OF SECONDARY METABOLITES

- 6.1 Production of penicillin.
- 6.2 Production of cephalosporin.
- 6.3 Production of streptomycin.
- 6.4 Vitamin production.
- 6.5 Production of SCP.

7.0 INDUSTRIAL PROCESS AND PROCESS ECONOMICS

- 7.1 Description of industrial process.
- 7.2 Process flow heating.
- 7.3 Process economics.

BOOKS:

1. "Bioprocess Engineering: Basic Concepts" by Michael Shuler and Fikret Kargi.
2. "Bioseparation Science and Engineering" by Roger Harrison

INDUSTRIAL BIOTECHNOLOGY

L 4	T 0	P 0		BTT 604
Total Contact hours. : 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks : 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

Rational:

Industrial biotechnology by its iterative rational design is a powerful tool to both test general theories as well as to develop more useful techniques to be used in biotechnological processes or products. Since prehistoric times, humans have taken advantage of the beneficial activities of microbes. However, it has only been within the past forty years that these activities have been harnessed for the large-scale production of microbial cells and their products. Microbiologist, engineers and biotechnologist have come together to develop the field of industrial microbiology. By controlling the activities of certain microbes, they have made possible the simpler, more economical production of large quantities of useful products such as enzymes, amino acids, vitamins, antibiotics, organic acids and alcohol.

Objective:

After completion of the study of Industrial Biotechnology the student will be able.

1. To know the role and application of different beneficial micro organisms for the development of Industry.
2. To know the production of different types of alcohols and beverages by the help of micro-organisms in the plants or reactions.
3. To know the preservation of food and their packaging this helps in the storage of food for a prolonged period.
4. To know about the progress in plant research and drug discovery

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Introduction to Industrial Biotechnology	15
2.	Ethanol Production and Food Preservation	15
3.	Biogas Generation and Composition	10
4.	Drugs from Plants	10
5.	Packaging of Food	10
	Total	60

1.0 INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY

- 1.1 Cultivation of microbes.
- 1.2 List out different alcoholic beverages.
- 1.3 Alcohol manufacturing process.
- 1.4 Production of Butanol.
- 1.5 Production of vinegar.
- 1.6 Roles of microbial enzymes in industry.

- 1.7 Microbial assays.
- 1.8 Industrial spoilage and its prevention.

2.0 ETHANOL PRODUCTION AND FOOD PRESERVATION

- 2.1 Ethanol production in industries.
- 2.2 Food preservation by benzoic acid and its salts.
- 2.3 Preservation of food through NaCl and sugars.
- 2.4 Storage stability of frozen foods and effect of freezing upon microorganisms.
- 2.5 Thermal destruction of microorganisms.
- 2.6 Preparation and drying of low-moisture foods
- 2.7 Preservation of food by radiation.
- 2.8 Microwave processing of food.

3.0 BIOGAS GENERATION AND COMPOSITION

- 3.1 Suspended growth systems
- 3.2 Supported growth systems.
- 3.3 Different applications and pre-treatment.

4.0 DRUGS FROM PLANTS

- 4.1 The role of plants in drug discovery and development.
- 4.2 Progress in plant research and list out some important plant drugs.
- 4.3 Recently developed plant based drugs.

TEXT BOOKS/REFERENCE.

1. Industrial Biotechnology: P.R.Yadav, Rajiv Tyagi

BIOINFORMATICS

L 4	T 0	P 0		BTT 604
Total Contact hours. : 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks : 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

Rational:

Bio-informatics is the science of using information to understand biology. In Bioinformatics biology, computer science and mathematics merge into a single discipline. So, Bioinformatics is a larger subject of the computational biology. Bio-informatics not only provides theoretical background and practical tools for scientists to analyze proteins and DNA but also helps in sequence homology analysis and drug design.

Objective:

After completion of the study of bio-informatics the student will be able:

1. To know about the relation between biological science and computer science.
2. To know about the detailed structure of a program in relation to biological field.
3. To know about sequencing and alignment of different biological molecule through computer programming.
4. To know about the application of computer sciences in identification and development of biological science.

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Introduction to Bio-informatics	10
2.	Data bases and their uses and Dynamic programming	15
3.	Sequencing and alignment	15
4.	Evolutionary trees and phylogeny	10
5.	Special topics in Bioinformatics	10
	Total	60

1.0 INTRODUCTION TO BIOINFORMATICS

- 1.1 Scope of bioinformatics.
- 1.2 Different elementary commands and protocols.
- 1.3 Internet, World Wide Web, Browsers.
- 1.4 World Wide Web.
- 1.5 Browsers.

2.0 DATA BASES AND THEIR USES AND DYNAMIC PROGRAMMING

- 2.1 Importance of databases.
- 2.2 The types of databases.
- 2.3 Functions of databases.
- 2.4 Applications of databases.
- 2.5 FASTA and BLAST.
- 2.6 PAM and BLOSSUM.

3.0 SEQUENCING, ALIGNMENT AND DYNAMIC PROGRAMMING

- 3.1 Algorithms.
- 3.2 Pair wise alignment.
- 3.3 Multiple sequence alignment.
- 3.4 Carrying out a sequence search.
- 3.5 Gaps and mismatches.
- 3.6 Edit distance.

4.0 EVOLUTIONARY TREES AND PHYLOGENY

- 4.1 Evolutionary tree.
- 4.2 Polygenetic tree.
- 4.3 Tree building method.

5.0 DNA AND PROTEIN SEQUENCING AND ANALYSIS

- 5.1 Gene production strategies.
- 5.2 Protein production strategies
- 5.3 Protein production programming.
- 5.4 Briefly molecular visualization.

TEST BOOKS/REFERENCE

1. Introduction to Bioinformatics – T.K. Attwood & B.J. Perry Smith (Pearson Education Publ.)

PHARMACEUTICAL BIOTECHNOLOGY

L 4	T 0	P 0		BTT 604
Total Contact hours. : 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks : 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

Rational:

The progress in the field of Biotechnology 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. 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 become reality now. The biotechnological products have already gained 10% share of the pharmaceutical market of United States. It is expected that pharmaceutical biotechnology will attain a twofold expansion by the turn of this century.

Objective:

After completion of the study of pharmaceutical biotechnology the student will be able:

1. To know about the relationship between pharmacy and biotechnology.
2. To know about the different economically important enzymes and their role in industries.
3. To know about gene therapy and its application for the treatment of different diseases.
4. To know about different types of drugs and their process of targeting inside the cell.
5. To know about pharmaceutical applications in cell culture.

Topic wise distribution of periods

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

1.0 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

2.0 Drug kinetics and bio pharmaceuticals

2.1 Mechanism of drug absorption, distribution, metabolism and excretion

2.2 factors affecting the ADME process

2.3 Bioequivalence

3.0 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

4.0 Biopharmaceuticals

4.1 principles of pharmacology

4.2 Pharmacokinetics and Pharmacodynamics. Explain it

4.3 Study of a few classes of therapeutics like Recombinant therapeutics, Monoclonal Antibodies, Vaccines, Gene therapy, Antibiotics and Hormones.

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, DNase, Factor VIIa, Factor IX, Activated protein C, Monoclonal antibodies etc.

TEXT BOOKS/REFERENCES

1. Pharmaceutical Biotechnology by: S.P. Vyas and V.K. Dixit.

2. Molecular Biology: H.D Kumar

FOOD BIOTECHNOLOGY

L 4	T 0	P 0		BTT 604
Total Contact hours. : 60 Theory : 60 hours Theory Exam. : 3 hours.			Total Marks : 100	End Exam.: 70 marks Class Test 20 marks Teacher's Assignment: 10 marks

Rational:

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.

Objective:

After completion of the study of food biotechnology the student will be able:

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

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

1. 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)
- 1.4 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)

2. 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

3. 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)

4. 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) Color
 - (b) Size and shape
 - (c) Viscosity and consistency
 - (d) Texture
 - (e) Flavor

5. 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, flavor profile)
- 5.3 Quality control in bakery industry, of raw material, of finished products, of packaging materials

Reference Books:

- 1. Food Science- N. N Potter, CBS Publication
- 2. Food microbiology – Frazier
- 3. G. Reed, Prescott and Dunn's Microbiology, CBS Publishers
- 4. Principles of food Preservation – Moris, Chapman & Hall
- 5. Food Analysis – R. Lees, C. R. C. Press Inc

INSTRUMENTATION LABORATORY

L 0	T 0	P 4		BTP-601
Total Contact hours. : 60 Practical : 60 hours		Total Marks : 50 Practical Exam. : 4 hours		Practical Exam. :25 marks Sessional: 25 marks

List of experiments

Sr No	Name of Experiment	Periods
1	Demonstrate different types of pressure gauges and temperature measuring device.	06
2	Determine the pH of a given solution by using pH meter	04
3	Calibration of a thermocouple	06
4	Demonstrate function of digital multi-meter	04
5	Demonstrate operation of a Calorimeter	04
6	Find the concentration of sugar solution by using polarimeter.	06
7	Determine the separation of components by using thin layer electrography	08
8	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	12
9	Demonstrate the slab gel electrophoresis.	10

DOWNSTREAM PROCESSING LABORATORY

L 0	T 0	P 4		BTP-602
Total Contact hours. : 60 Practical : 60 hours		Total Marks : 50 Practical Exam. : 4 hours		Practical Exam. :25 marks Sessional: 25 marks

List of experiments

Sl. No	Name of Experiment	Periods
1	Conventional filtration	10
2	Membrane based filtration	10
3	Cell disruption techniques.	10
4	Centrifugation in batch and continuous.	05
5	Protein precipitation and recovery.	05
6	Ion exchange chromatography.	10
7	Electrophoresis	10

BIOPROCESS ENGINEERING LABORATORY

L 0	T 0	P 4		BTP-603
Total Contact hours. : 60 Practical : 60 hours		Total Marks : 50 Practical Exam. : 4 hours		Practical Exam. :25 marks Sessional: 25 marks

List of experiments

Sl. No	Name of Experiment	Periods
1	Isolation of industrially important organism for microbial process.	12
2	Determination of thermal death point of microorganism.	12
3	Determination of growth of microorganism.	12
4	Determination of substrate degradation profile.	12
5	Ethanol production using different substrate.	12

PROJECT WORK-2

L 0	T 0	P 6		BTP-604
Total Contact hours. :90 Practical : 60 hours			Total Marks : 100 Practical Exam. : 4 hours	Practical Exam. :50 marks Sessional: 50 marks

The students are required to carry out one of the following projects.

1. Processes based Project: Manufacture of product.
2. Equipment based Project: Detailed design and fabrication of the equipment for a given capacity.
3. Experimental based Project: Experimental investigation of basic or applied research problem.
4. 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.
5. Research Oriented: Any application/renovation/modification of a latest technology

The Project Work consists of collection of literature, study of the various processes selection of the process, computation of material and energy balances, process design of important pieces of equipment, detailed design of one of the main equipment, plant location & layout cost Estimation, economic analysis, details of experimental set up, analysis of data, pollution control, safety, marketing, conclusions and recommendations, bibliography, etc., as applicable to the individual problem.

The objective of the project is to make use of the knowledge gained by the student at various stages of the DIPLOMA course. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the course. Each group should consist of maximum 10 students. For term-work (Internal) 25marks, the assessment should be by conducting frequent written tests, seminars during the semester & an oral examination at the end of the semester conducted by all the staff members of the department. The Head of the Department should see that the assessment procedure should be the same for all the students of the class. For external 50 marks, the project work shall be assessed by an oral examination to be held by at last two examiners, one internal and one must by external at the end of the semester.

The objective of the VIVA VOCE examination (Internal and External Orals) is to determine whether the objectives of the project work have been met by the student as well as to assess the originality and initiative of the student as demonstrated in the project work.