DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD/SU/B.E./Syllabi/95/2014

It is hereby informed to all concerned that, the syllabus prepared by the Boards of Studies, Ad-hoc Board, Committees and recommended by the Faculty of Engineering and Technology, the Academic Council at its meeting held on 08-07-2014 has accepted the following **"Revised Syllabi for all Branches of [B.E.]"** as appended herewith :-

Sr.No.	Revised Syllabi
[1]	B.E. Civil Engineering,
[2]	B.E. Mechanical Engineering,
[3]	B.E. Electrical Engg. / EEP / EE/EEE.,
[4]	B.E. Computer Science & Engineering,
[5]	B.E. Information Technology,
[6]	B.E. ECT/EC/E&C/I.E,
[7]	B.E. Instrumentation & Control / Instrumentation,
[8]	B.E. Biotechnology,
[9]	B.E. Chemical Engineering.

This is effective from the Academic Year 2014-2015 and onwards.

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

University Campus,
Aurangabad-431 004.
REF.NO. ACAD/ SU/ B.E/
SYLLABI / 2014/16605-36
A.C.S.A. I.No.447[03].

Date:- 13-08-2014.

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Director,
Board of College and
University Development.

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Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload the above all syllabi on University Website.**

Copy to :-

1] The Controller of Examinations,

2] The Superintendent, [Engineering Unit],

3] The Programmer [Computer Unit-1] Examinations,

4] The Programmer [Computer Unit-2] Examinations,

5] The Superintendent, [Eligibility Unit] ,

6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,

7] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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S/130814/-*

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus of

B.E.

BIOTECHNOLOGY

UNDER THE FACULTY OF ENGINEERING & TECHNOLOGY.

[Effective from 2014-15 & onwards]

FACULTY OF ENGINEERING AND TECHNOLOGY

Proposed Revised Syllabus

Final Year of Engineering in Biotechnology

Sub no	Semester VII (Part I)	Contact Hrs/Week				Examination scheme					
	Subjects	L	T	P	Total	CT	TH	TW	PR	Total	Duration of theory examination
BTD 401	Fermentation Technology II	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 402	Introduction to Biological Programming	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 403	Biochemical Reaction Engineering	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 404	Animal Cell Science & technology	4	-	-	4	20	80	-	-	100	3 Hrs
	Elective I*	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 421	Fermentation Technology Lab	-	-	4	4	-	-	25	50	75	-
BTD 422	Introduction To Biological Programming Lab	-	-	2	2	-	-	-	50	50	-
BTD 423	Biochemical reaction Engineering Lab	-	-	2	2	-	-	25	50	75	-
BTD 424	Project Part I	-	-	4	4	-	-	50	-	50	-
	Total (Part I)	20	-	12	32	100	400	100	150	750	-

*Elective Part I

CODE	SUBJECT
BTD 441	Food Biotechnology
BTD 442	Environmental Biotechnology
BTD 443	Open Elective

Sub no	SEMESTER VIII (Part II)	Contact Hrs/Week				Examination scheme					
	Subjects	**L**	T	**P**	**Total**	**CT**	**TH**	TW	**P**	Total	**Duration of theory examination**
BTD 451	Advanced Genetic Engineering	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 452	Unit Operations	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 453	Nanotechnology	4	-	-	4	20	80	-	-	100	3 Hrs
	Elective II**	4	-	-	4	20	80	-	-	100	3 Hrs
BTD 471	Advanced Genetic Engineering Lab		-	4	4	-	-	25	50	50	~~Hrs~~
BTD 472	Unit Operations Lab	-	-	2	2	-	-	25	50	50	-
BTD 473	Project Part II		-	4	4	-	-	100	100	150	-
	Total (Part II)	**16**	-	**10**	**26**	80	**320**	**150**	200	750	-

****Elective Part II**

CODE	SUBJECT
BTD 491	Bioethics, Biosafety and Intellectual Property Rights
BTD 492	Modeling and Simulation
BTD 493	Open Elective

L: Lecture hours per week
Theory Examination
T:Tutorial hours per week

P: Practical hours per week
TW: Term Work

CT: Class Test TH: University
P: Practical/Oral Examination

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 401 **Title: Fermentation Technology II (FT II)**

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ PREREQUISITES

Prior knowledge of microbiology, biochemistry, metabolic pathways, fermentation Technology I and Bioseparation Techniques is desirable

➢ OBJECTIVES

1. To understand and implement a typical acrobic bioprocess protocol for any industrially significant metabolite.
2. To understand and implement a typical acrobic bioprocess protocol for any industrially significant metabolite.
3. To understand, implement and analyze various critical parameters involved in brewing and dairy processes.
4. To understand the mechanism and factors affecting biocatalysis and biotransformation processes.
5. To able to design any suitable bioprocess protocol for any industrial metabolite via fermentation route.

COURSE CONTENTS

SECTION A

UNIT 1: PRODUCTION OF INDUSTRIALLY SIGNIFICANT METABOLITES BY AEROBIC FERMENTATION PART I (08 Hrs)

Introduction, metabolic pathways, upstream processing, downstream processing, recombinant methodology (if any), industrial applications of the following metabolites has to be dealt

1. Antibiotics: penicillin, tetracyclineand streptomycin
2. Organic acids : citric acid and gluconic acid
3. Amino acids : glutamic acid and lysine
4. Microbial biomass : Yeast, *Rhizopus*, *B. thuringenesis*

UNIT 2: PRODUCTION OF INDUSTRIALLY SIGNIFICANT METABOLITES BY AEROBIC FERMENTATION PART II (04 Hrs)

Introduction, metabolic pathways, upstream processing, downstream processing, recombinant methodology (if any), industrial applications of the following metabolites has to be dealt

1. Vitamins: B_1 and B_{12}
2. Polysaccharides: Xanthan gum and dextran
3. Polyols: glycerol
4. Pigments : caratenoids, lycopene

UNIT 3: PRODUCTION OF INDUSTRIALLY SIGNIFICANT METABOLITES BY ANAEROBIC FERMENTATION (07 Hrs)

Introduction, metabolic pathways, upstream processing, downstream processing, recombinant methodology (if any), industrial applications of the following metabolites has to be dealt for lactic acid fermentation, acetone, butanol and ethanol production

SECTION B

UNIT 4: BIOCATALYSIS, BIOCONVERSIONS AND BIOTRANSFORMATIONS (06 Hrs)

Overview of biocatalysis and biotranformations, use of lipase, transaminase in biocatalysis and biotranformation reactions with atleast two industrial examples

UNIT 5: BREWING AND DAIRY TECHNOLOGY (10 Hrs)

1. Brewing Technology: production, recovery and quality control aspects of manufacturing of wine, whisky and beer
2. Dairy technology
   Culture butter milk – processing of milk, starter culture; probiotic milks
   Yoghurt manufacturing – types, raw materials, yoghurt processing and quality assurance
   Cheese technology: milk composition, treatment to milk, milk coagulation, curd treatment, process of cheese manufacturing.
   Whey Technology: whey fermentation, whey beverages and whey utilization

UNIT 6: PRODUCTION OF RECOMBINANT THERAPEUTIC PROTEINS AND VIRAL VACCINES (05 Hrs)

Bioprocess aspects in production of recombinant proteins into *E. Coli* : high density cell cultivation and any suitable case study; *P. Pastoris*: conceptual basis for *P. Pastoris* expression system, high level expression in fermenter, glycosylation and any suitable case study; purification strategies for recombinant proteins giving emphasis on gel permeation chromatography, affinity chromatography and affinity tags

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

➢ RECOMMENDED BOOKS

Text Books

1. Production of recombinant therapeutic proteins by Chirnajib Chakraborty, Biotech books, New Delhi.
2. Manufacturing yoghurt and fermented milks, 2nd edition, Ramesh chandan and Arun Kilara, wiley balckwell publications.
3. R. Ananthanarayan and C. K. Jayaram Paniker (2010) Textbook of Microbiology 8th ed. Universities Press.

Reference Books

1. Moo-Young M. ed. (1985) Comprehensive Biotechnology vol: I & II, Pergamon Press N.Y.
2. Ratledge C and Kristiansen B. eds. (2001) Basic Biotechnology 2nd ed. Cambridge Univ Press Cambridge.
3. Rehm, H. J., and G. Reed (1993): Biotechnology. A Comprehensive Treatise, VCH, VOL 1-8.

➢ PATTERN OF QUESTION PAPER

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (I, II, III) and Section B questions on remaining three units (IV, V, VI) . Question paper should cover the entire syllabus.

➢ FOR 80 MARKS PAPER

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least eight bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks

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FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 402

Title : Introduction to Biological Programming (IBP)

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ PREREQUISITE

Computational Biology

➢ OBJECTIVES

1. To understand the nature of programming as human activity
2. To learn and experience main components of programming process
3. To understand main control structures of procedural programming languages
4. To learn and being able to use major programming patterns
5. To understand the principles of data storage and manipulation
6. Understand the basics of how microarray technology works
7. Understand and critique existing methodology for the analysis of microarray data
8. Write R code to import and analyze microarray data.
9. To apply Python for bioinformatics applications.
10. Introduce Python with reference to bioinformatics

COURSE CONTENTS

SECTION A

Unit I: The Basics Of C++ (06 Hrs)
Introduction:Compilers, Basics of C++:Structure of a program, Variables and types, Constants, Operators, Basic Input/Output

UNIT II: PROGRAM STRUCTURE (08 Hrs)
Statements and flow control; Functions; Overloads and templates; Name visibility

UNIT III: COMPOUND DATA TYPES & INTRODUCTION TO CLASSES (06 Hrs)
Arrays; Dynamic memory; Data structures; Other data types; Classes: Special members and properties

SECTION B

UNIT IV: PRINCIPLES OF OBJECT ORIENTED PROGRAMMING (OOP) **(08 Hrs)**

OOP paradigm - Basic concepts of OOP - Benefits of OOP - Object Oriented Languages – abstraction – inheritance – encapsulation – polymorphism - Applications of OOP.

UNIT V: INTRODUCTION TO STANDARD TEMPLATE LIBRARY (STLS) **(07 Hrs)**

ifstream; ofstream; iostream; string; stringstream; vector; map; algorithm; numeric;

UNIT VI: BIOLOGICAL PROGRAMMING **(05 Hrs)**

Introduction of BioInt: biological programming environment (BPE)
The basics of R software and the key capabilities of the Bioconductor project.
Introduction to BioPython:Python libraries and applications which address the needs of current and future work in bioinformatics

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

➢ **RECOMMENDED BOOKS**

Textbooks

1. E.Balagurusamy, Object oriented programming in C++, Third Edition, Tata McGraw Hill Publications, 2007.
2. *Bioinformatics and Computational Biology Solutions Using R and Bioconductor* edited by Robert Gentleman, Vincent Carey, Wolfgang Huber, Rafael Irizarry, Sandrine Dudoit
3. Jason Kinser, "Python for Bioinformatics", Jones & Bartlett Publishers, 2008

Reference Books

1. Mark Lutz, "Learning Python", 3rd edition, O'Reilly, 2007.
2. Alex Martelli, David Ascher, "Python cookbook", O'Reilly, 2002
3. Turbo C/C++ - The complete reference - H. Schildt
4. www.r-project.org – R programming languages
5. www.bioconductor.org – Bioconductor
6. www.biobhasha.org – BioInt – An integrated biological programming environment

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FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 403 Title : Biochemical Reaction Engineering (BCRE)

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ OBJECTIVES

1. To understand different types and mechanisms of chemical and biochemical reactions
2. To understand data analysis and its subsequent use in reactor designing
3. To understand and implement the and correlate the theoretical principles in biotechnology field

COURSE CONTENTS

SECTION A

UNIT1: INTRODUCTION TO RECTION ENGINEERING **(03 Hrs)**
Overview of chemical reaction engineering, classification of reactions, rate of reaction and variables affecting it, speed of chemical reactions.

UNIT 2: HOMOGENEOUS REACTIONS **(06 Hrs)**
Homogeneous reactions in ideal reactors, kinetics of homogeneous reactions, simple reactor types, the rate equation, single and multiple reactions, elementary and non-elementary reactions, molecularity and order of reaction, rate constant, temperature dependent term of a rate equation, reaction rate from theory.

UNIT 3: BATCH KINETICS **(07 Hrs)**
Interpretation of batch reactor data, constant volume batch reactor, varying volume batch reactor, temperature and reaction rate, rate equation.

SECTION B

UNIT 4: RECTOR DESIGN **(08 Hrs)**
Introduction to reactor design, ideal reactors for a single reaction, ideal batch reactor, space-time and space-velocity, steady state mixed flow reactor, steady state plug flow reactor, holding time and space time for flow reactors.

UNIT 5: TYPES OF REACTIONS **(08 Hrs)**

Design for single reactions, size comparison of single reactors, batch reactor, mixed versus plug-flow reactors, multiple reactor systems, recycle reactor, autocatalytic reactions

UNIT 6: APPLICTIONS IN BIOTECHNOLOGY **(08 Hrs)**

Introduction to biochemical reaction systems. enzyme fermentation, Michaelis-Menten kinetics, batch fermentor, plug flow fermentor, mixed flow fermentor, inhibition by a foreign substance – competitive and noncompetitive inhibition.

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

➢ RECOMMENDED BOOKS

Textbooks

1. Chemical Reaction Engineering by Octave Levenspiel, John Wiley and Sons.
2. Elements of Chemical Reaction Engineering by H. Fogler.

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 404

Title : Animal Cell Science and Technology (ACST)

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ OBJECTIVES

1. To understand the fundamentals of animal cell culture with respect to its isolation, cultivation, preservation and quality control
2. To understand the process of invitro exploitation of animal cell lines for industrial metabolite production

COURSE CONTENTS

SECTION A

UNIT 1: INTRODUCTION TO BASICS PRINCIPLES (05 Hrs)

Background, history, microtitre technology, new products (interferons, antibodies), genetically derived products (tpa, EPO), gene therapy, advantages and disadvantages of tissue culture, types of tissue culture, biology of cells, choice of materials, procedure, typical instruments used in animal cell culture.

UNIT 2: FUNDAMENTALS OF CELL CULTURE (10 Hrs)

1. Water: common impurities in water, pure standard of water, water purification techniques, water purity monitoring and validation.
2. Sterilization: wet heat, dry heat, irradiation, chemical sterilization, filtration and elimination of viruses and prions
3. Biology of cultures cells: Microscopy of cells, cell adhesion cell differentiation, cell signalling, initiation and evolution of and development of continuous cell lines
4. Types of cultures: monolyer culture, suspension culture and immobilized culture

UNIT3: MEDIA DEVELOPMENT (06 Hrs)

Physicochemical properties, balanced salt solution, complete media, serum, selection criteria, other supplements; serum free media – advantages and disadvantages of serum free media, replacement of serum, development and preparation of serum free media, protein free media, Response curves, cryopreservation and safety aspects while handling cell lines.

SECTION B

UNIT 4: PRIMARY CELL CULTURE, CLONING AND QUALITY CONTROL (05 Hrs)

Primary cell culture: Introduction, methods and approaches; subculture, Cloning: introduction, methods and approaches; characterization and differentiation, transformation, Three dimensional cell culture

UNIT 5: QUALITY CONTROL, VIABILITY AND CYTOTOXICITY (06 Hrs)

Quality control: specifications and various methods used in its quality control
Viability and cytotoxicity: specific techniques, assay methodology, end points

UNIT 6: SCALE UP (08 Hrs)

Scale up of suspension cultures, scale up in monolayer and process control

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

- **RECOMMENDED BOOKS**

Textbooks

1. R. Ian Freshney (2005) Culture of Animal Cells: A manual of basic techniques, John Wiley and Sons

Reference Books

1. Glyn Stacy and John Davis (2007) Medicines from animal cell culture, Wiley Publications.
2. John M Davis (2011) Animal Cell Culture-Essential methods Wiley Blackwell.
3. Michael Butler (2004) Animal Cell Culture and Technology, 2nd edition, Bios Scientific Publishers, London and New York
4. R W Masters (2000) Animal Cell Culture A Practical Approach, Third Edition Oxford University Press.

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FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII
Elective I

Course Code : BTD 441 **Title : Food Biotechnology (FB)**

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ **OBJECTIVES**

1. To understand the correlation between Food Technology and Biotechnology
2. To understand the different unit operations used in the field
3. To understand the quality control parameters of the products of Food Biotechnology

COURSE CONTENTS

SECTION A

UNIT 1: OVERVIEW OF FOOD BIOTECHNOLOGY **(06 Hrs)**

Biotechnology in relation to the food industry, Food processing, Unit operations in food industry. Preliminary processing methods, Method of studying food process engineering, Role and significance of microorganisms in foods, Intrinsic and Extrinsic Parameters of Foods that affect microbial growth.

UNIT 2: FOOD ADDITIVES AND MICROBIAL SAFETY **(08 Hrs)**

Food quality and control, Analysis of food, major ingredients present in different products, Food additives like colour, flavour, vitamins, preservatives, Microbial safety of food products, Chemical safety of food products, heavy metal, fungal toxins, pesticide and herbicide contamination.

UNIT 3: FOOD PRESERVATION **(08 Hrs)**

Food Preservation Using Irradiation, Characteristics of Radiations of Interest in Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Processing of Foods for Irradiation, Application of Radiation, Radappertization, Radicidation, and Radurization of Foods Legal Status of Food Irradiation, Effect of Irradiation of Food constituents. Storage Stability Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying, Indicator and Food-borne Pathogens,Other Proven and Suspected Food-borne Pathogens.

SECTION B

UNIT 4: MICROBIAL TECHNOLOGY IN PRODUCTION OF DIFFERENT FOOD PRODUCTS **(05 Hrs)**

Technologies used for microbial production of food ingredients. biotechnology of microbial polysaccharides in food, microbial biotechnology of food flavor production, microbial production of oils and fats, food applications of algae, Production of caretenoids.

UNIT 5: FUNCTIONAL FOODS (NUTRACEUTICALS) **(08 Hrs)**

Probiotics, prebiotics and symbiotic Nutraceuticals supplements, safety, major Nutraceuticals and their applications. Lycopene, octacosanol, melatonin, Resveratrol, luetin. Trends in caretenoids Biotechnology.

UNIT 6: DEVELOPMENTS IN FOOD BIOTECHNOLOGY **(05 Hrs)**

Antioxidants and food stability, Natural antioxidant functionality during food processing. Recent Developments in Food Biotechnology. Recent Developments. food processing. Applications of food biotechnology.

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

- **RECOMMENDED BOOKS**

1. Banwart, G.J. Basic Food Microbiology. Van No Strand Reinhold Publishers, New York.
2. Food science by Norman N. Potter, Joseph H. fifth edition aspen publication
3. Food Microbiology: Fundamentals and frontiers by M.P. Doyle, L.R. Beuchat and Thoma J. Montville, (2001), 2nd edition, ASM press, USA
4. Food Biotechnology, Second Edition edited by Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin CRC Press
5. Food Biotechnology Ulf Stahl, Ute E.B. Donalies, Elke Nevoigt, David B. Archer.
6. Frazier, W.C. and Westhoff. Food Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
7. Food science and food biotechnology by *Gustavo F. Gutiérrez-López,* CRC PRESS Boca Raton London New York Washington, D.C.
8. Antioxidants in food by Jan Pokoronay Woodhead publications.

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FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII
Elective I

Course Code : BTD 442 **Title : Environmental Biotechnology (EB)**

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ **OBJECTIVES**

1. To understand various factors attributing the environmental pollution
2. To understand the role of biotechnological processes in controlling the environmental pollution

COURSE CONTENTS

SECTION A

UNIT 1: INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY (04 Hrs)
Background, history, types of pollutants, global environmental problems, need of biotechnology, advances in biotechnology in recent years.

UNIT 2: ENVIRONMENTAL PRETURBATIONS AND ITS CONTROL (08 Hrs)
Environmental resources, air pollution-causes, types and its management; Water pollution-causes and its management; eutrophication

UNIT 3: SOIL AND SOLID WASTE POLLUTION AND MANAGEMENT (08 Hrs)
Soil and solid waste pollution, Soil erosion, Water erosion, Wind erosion, Sun erosion, Salination, Waste monitoring, Management of solid waste including medical waste, hazardous waste; Soil conservation and control

SECTION B

UNIT 4: BIOREMEDIATION, BIOSORPTION AND BIODEGRADATION OF XENOBIOTICS (07 Hrs)
Bioremediation- microorganisms in bioremediation, contamination of soil and ground water, bioremediation systems and technologies
Biosorption – heavy metals, microbes used n biosorption, mechanism, factors and reactors used for biosorption, phytoremediation
Biodegradation of Xenobiotics – xenobiotic compounds, chemical properties of xenobiotics, microorganisms, mechanism of degradation

UNIT 5: ROLE OF ENVIRONMENTAL BIOTECHNOLOGY IN REDUCING INDUSTRIAL POLLUTIONS **(06 Hrs)**

Implications of biotechnology in effluent control of various industries like-Pesticide industry, tannery and leather industry and paper and pulp industry, dairy industry and dye industry.

UNIT 6: RESPONSIBLE MANAGEMENT OF BIOTECHNOLOGIES **(06 Hrs)**

Bioengineering perspectives, ethics, systematic biotechnology, green engineering, bioengineering safety, reliability of biotechnology and biotechnological systems

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

- **RECOMMENDED BOOKS**

Textbooks

1. Environmental Biotechnology: basic concepts and application by Indu Shekhar Thakur (2006), IK International
2. Environmental Biotechnology: industrial Pollution and Management by S. N. Jogdand (2003) 2nd edition, Himalaya Publishing House
3. Environmental Biotechnology by Bimla Singh (2006) Vista International Publishing house, New Delhi
4. Environmental Biotechnology by Pratham Vashisth (2005) Dominant Distributors and Publishers, New Delhi
5. Environmental Toxicology and Biotechnology by S K Dubey (2009) Dominant Distributors and Publishers, New Delhi

Reference Books

1. Environmental Biotechnology: Principles and Applications by M. Moo and Young, W. A Anderson and A. M. Chakraborthy; Springer Publications (2007)
2. Environmental Biotechnology a biosystem approach by Daniel A Vallero (2010) first edition, Academic Press Elsevier.
3. Environmental Biotechnology by T. Srinivas (2008) New Age International Publications, New Delhi
4. Environmental Biotechnology by Hans – Joachim Jordening and Josef Winter (2005) Wiley CH, Weinheim

5. Biotechnological Applications in Environment and Agriculture by P. K. Goel and G. R. Pathade (2004) ABD Publishers Jaipur

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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII
Elective I

Course Code : BTD 443 **Title : Open Elective**

Teaching Scheme	**Examination Scheme**
Theory: 04 Hours/Week	Class Test: 20 Marks
	Theory Examination (Marks) : 80 Marks
	Theory Examination (Duration) :03 Hours

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 421

Title :- Fermentation Technology II Lab

Teaching Scheme

Practical: 4 Hours/Week

Examination Scheme

Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration) : 04 Hours
Term Work: 25 Marks

➢ PRACTICALS

1. Aerobic metabolite production from chemically defined media and or agro industrial waste
   Enzymes : amylase/protease/cellulase
   Organic acids: citric acid/gluconic acid
   Secondary metabolite: antibiotic/pigment
   Microbial biomass: yeast/*Rhizopus*/*B. thurengenesis*
2. Anaerobic metabolite production from chemically defined media and or agro industrial waste like Lactic acid, ethanol
3. Isolation of proteins from milk and its HPLC analysis
4. Extraction and production of value added metabolites from agro industrial waste
5. Use of free and immobilized microbes for effluent treatment
6. Production of curd/yoghurt from milk
7. Wine production
8. Batch kinetic study of any industrially relevant metabolite
9. Estimation of k_La

➢ PATTERN OF PRACTICAL EXAMAMINATION

Minimum 6 practical's should be conducted from the above list. The practical examination shall consist of performing an experiment based on the practical work done during the course i.e. one major and one minor experiment during examination, the record of the experiments submitted by the candidate and viva-voce based on the syllabus.

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 422 **Title :- Introduction to Biological Programming**

Teaching Scheme
Practical: 02 Hours/Week

Examination Scheme
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration) :- 04 Hours

➢ PRACTICALS

1. Basic operations
2. Decision and loop control structure
3. Arrays
4. Functions
5. Writing C++ programs for simple Bioinformatics analysis: Extract a protein or nucleic acid sequence from any of the databank files (GenBank entry, Swiss-Prot, EMBL entry etc.)
6. Interconverting the sequence from one databank format to the other eg. GenBank format to FASTA format, FASTA to PIR format etc.
7. BioInt fundamentals: Generating the complimentary sequence of a DNA sequence Pattern search algorithms
8. Search for a specific oligonucleotide pattern (eg. GAACATCC) in a given DNA sequence.
9. Find the position where a specific sequence say "GGTCCCGAC" will hybridize a given DNA sequence.
10. Installation of the R Software and R Packages
11. PYTHON FUNDAMENTALS running programs, types and operations. Functions.

➢ PATTERN OF PRACTICAL EXAMAMINATION

Minimum 8 practical's should be conducted from the above list. The practical examination shall consist of performing an experiment based on the practical work done during the course i.e. one major and one minor experiment during examination, the record of the experiments submitted by the candidate and viva-voce based on the syllabus.

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code : BTD 423	Title :- Biochemical Reaction Engineering Lab
Teaching Scheme	Examination Scheme
Practical: 02 Hours/Week	Practical /Oral Examination: 50 Marks Practical /Oral Examination (Duration) : 04 Hours Term Work: 25 Marks

➢ PRACTICALS

1. Interpretation of batch reactor data.

2. To study the kinetics of liquid phase irreversible reaction in a batch reactor.

3. To study the kinetics of liquid phase reversible reaction in batch reactor.

4. Conversation in CSTR.

5. Conversation in PFR.

6. Saponification of Ethyl Acetate

7. To determine the pseudo first order rate constant. (TBC)

8. To study the kinetics of liquid phase reaction by dilatometer method.

9. To estimate nature of temperature dependency of rate constant of ethyl acetate with NaOH in dilute aqueous solution

➢ PATTERN OF PRACTICAL EXAMAMINATION

Minimum 8 practical's should be conducted from the above list. The practical examination shall consist of performing an experiment based on the practical work done during the course i.e. one experiment during examination, the record of the experiments submitted by the candidate and viva-voce based on the syllabus.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VII

Course Code :, BTD 424

Title :- Project Part I

Teaching Scheme

Practical: 04 Hours/Week

Examination Scheme

Term Work: 50 Marks

The project work is to impart training in biotechnology engineering. The knowledge gained by studying various subjects separately is utilized for a single task. The project trains to co-ordinate the knowledge of biotechnology principles assimilated over the period of course study.

This is an exercise in literature survey, report writing and team work. The project report reflects on the devotion of students towards work and single mindedness approach. A group of students (maximum 3) or single student will have to work on a topic assigned to them or him/her. One staff member will supervise the work of the students. The project work may involve experimental/ theoretical/computational work. Guidelines for the project is as given below

1. Project Group size = maximum 3 students.
2. The project is to be taken up at the start of the semester I and the project must be completed by the end of semester II.
3. While submitting the B. E project topic care is to be taken that project will be completed within the available time of two terms.
4. Project title should be precise, clear, approved by HOD and the topic should be related to the field of biotechnology. Commercial and Interdisciplinary projects should be encouraged.
5. Guide for the project group has to be a departmental faculty who also acts as the internal examiner of the said project group.
6. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved, discussion with guide, etc., duly signed by guide. This data should be used for finding the total man hours.
7. The group is expected to complete details Literature Survey, objectives of the work, work plan, etc in (B.E. first Term) seventh term, as a part of term work in the form of a joint report. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.
8. The guides should regularly monitor the progress of the project work.
9. Assessment of the project for award of term work marks shall be done by the guide and a departmental committee as per the guidelines given in the following table.

10. Only one report should be submitted per group as a part of term work submission.

Assessment of Project I Term work B. E has to be inline with the following format

Name of the project :
Name of the guide

Sr no	Exam seat no	Student name	Assessment by guide (70%)				Assessment by departmental faculty other than guide (30%)			Grand total
			LS	Report	Attendance	Total	Evaluation	Ppt	Total	
			10	20	05	35	05	10	15	50

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII

Course Code : BTD 451 Title : Advanced Genetic Engineering (AGE)

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ PREREQUISITE

Molecular Biology, Recombinant DNA Technology

➢ OBJECTIVES

1. To understand the fundamental principle of genetic engineering
2. To understand and apply the concepts of genetic engineering in various biotechnology sectors
3. To understand the moral and ethical issues involved in the process

COURSE CONTENTS

SECTION A

UNIT 1: OVERVIEW OF GENETIC ENGINEERING (05 Hrs)

Concept of genetic engineering, its history, importance, applications of genetic engineering; analysis of gene structure and function, analyzing and mapping genomes, genome sequencing, human genome project, transcriptome, proteome, metabolomes, interactomes

UNIT 2: GENETIC ENGINEERING AND INDUSTRIAL BIOTECHNOLOGY (10 Hrs)

Making proteins: native and fusion proteins, yeast expression system, baculovirus expression system, *E. Coli* expression system, mammalian cell lines

Protein engineering: rational design and directed evolution; industrial production and downstream processing; Concept of biosimilars and biologics, GMP; Enzymes: DNA aseI, alginate lyase, restriction endonuclease; Therapeutics: human interferon, human growth hormone, r-haematopoeitic growth factors, r-insulin, interleukins, bovine somatotropin, Monoclonal antibodies, viral vaccines

UNIT 3: MEDICAL AND FORENSIC APPLICATIONS OF GENETIC ENGINEERING (10 Hrs)

Diagnosis and characterization of medical conditions: siRNA, miRNA, Mechanism of RNA interference, Advantages & drawbacks, Application (viral diseases, macular degeneration, altering

pigmentation in plants etc) Diagnostics based on DNA chips and Micro-arrays. PCR based methods: Diagnosis of Cystic fibrosis by multiplex PCR, Detection of Thalassemia mutation using ARMS-PCR, Detection of Fragile X syndrome by FMR-1 gene trinucleotide repeat analysis, To distinguish patient and donor cells as different using hypervariable tandem repeat polymorphic DNA markers, Identification of bacterial species based on the sequences of their 16S ribosomal RNA genes; gene therapy. DNA profiling: Criminal investigation (personal identification), Immigration, Paternity dispute, Identification of missing children, bodies found in plane crash, road accidents etc. Case study: world trade centre tragedy

SECTION B

UNIT 4: GENETICALLY MODIFIED PLANTS (10 Hrs)

Gene transfer methods in plants: Gene gun, Agrobacterium mediated etc. developing insect-resistance, disease-resistance, herbicide resistance in plants and delaying ripening (Flav savr Tomato); Developing stress and senescence-tolerance in plants, oxidative, salt and submergence stress; Developing quality of seed storage, Provitamin A; Wild plant relatives as a source of novel genes; Plants as bioreactor - plantibodies, polymers, foreign proteins in seeds; Varietal identification of plants: Dominant & co-dominant markers, Applications: Somaclonal varients, characterization of wild varieties and identification of morphologically similar plants; genetic engineering in various plant models (one or two case studies)

UNIT 5: GENETICALLY MODIFED ANIMLAS (07 Hrs)

Transfer, transmission and expression of transgenes, transgenic mice, transgenic livestock, transgenic chicken, transgenic fish; genetic engineering in various animal models like C. elegans, Mouse, Zebra fish and Drosophila

UNIT 6: THE ETHICS OF GENETIC ENGINEERING (03 Hrs)

Benefits, Risk & drawbacks of Genetic Engineering, Technical & religious issues, GM food: Toxicological aspects of GM crop (Cry1A, Cry 1B gene, allergy etc), Biodiversity, patenting issues, FDA regulations, Case study: Bt bringle, bt corn

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

➢ RECOMMENDED BOOKS

Textbooks

1. An Introduction to Genetic Engineering by Desmond S. T Nicholl, Cambridge University Press (2007)

Reference Books

1. Moo-Young M. ed. (1985) Comprehensive Biotechnology vol: I & II, Pergamon Press N.Y.
2. Rehm, H. J., and G. Reed (1993): Biotechnology. A Comprehensive Treatise, VCH, VOL 1-8.
3. Plant biotechnology In Agriculture: K. Lindsey and M.G.K. Jones (1990), Prentice hall, New Jersey.
4. Agricultural Biotechnology by Aric Altman. Marcel Dekker, Inc., 270 Madison Avenue, New. York, USA. 1998

➢ PATTERN OF QUESTION PAPER

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (I, II, III) and Section B questions on remaining three units (IV, V, VI) . Question paper should cover the entire syllabus.

➢ FOR 80 MARKS PAPER

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least eight bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks.

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII

Course Code : BTD 452
Teaching Scheme
Theory: 04 Hours/Week

Title : Unit Operations (UO)

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ OBJECTIVES

1. To understand various types of unit operations and equipments used industrially
2. To understand and implement the mathematical and theoretical principles underlying it.
3. To understand, select and thereby implement a particular unit operation for the said process.

COURSE CONTENTS

SECTION A

UNIT 1: MOLECULAR DIFFUSION (06 Hrs)

Fick's law of diffusion, Steady state molecular diffusion, equimolecular counter diffusion, Maxwell's law of diffusion, theories of mass transfer. Inter phase mass transfer; diffusion between two phases, local and overall mass transfer coefficients, steady state co-current and counter current processes, stage wise and differential contacts. Concept of theoretical stages, stage efficiency, height of mass transfer units.

UNIT 2: CYRSTALLIZATION (06 Hrs)

Solubility, solubility curves, super saturation, mechanism of crystallization, methods of supersauration, MIERS saturation theory, yield of process, forms of crystal, caking of crystals. Classification of crystallizers and its respective examples.

UNIT 3: DRYING (07 Hrs)

Theory and mechanism of Drying, Determination of batch drying, direct and indirect driers, freeze drying, rate of drying curve, mechanism of batch drying, cross circulation drying, liquid and vapour diffusion, unsaturated surface drying. Drying equipments used in industries.

SECTION B

UNIT 4: DISTILLATION (08 Hrs)

Flash distillation, differential distillation, continuous fractionation, modeling by method of McCabe & Thicle, introduction to multicomponent distillation, azeotropic distillation, and extractive distillation.

UNIT 5: EXTRACTION AND LEACHING (05 Hrs)

Liquid-Liquid Extraction: solvent properties, Solvent extraction, ternary liquid equilibria, staged calculation, spray column, packed and plate column, mixer settlers, analysis on solvent free basis.
Leaching: Principles steady state operation, unsteady state operation, single and multistage operations leaching calculation. Application of extraction to biological system, batch operation.

UNIT 6: SIZE REDUCTION, DISTRIBUTION,SEPARATION AND SCREENING (08 Hrs)

Law of Size reduction, types of equipment used and their selection. Open and Closed Circuit Operation, Crushers, Ball Mill, Rod Mill etc.Energy relationship in size reduction.Particle size analysis. Methods of representation of size analysis, shape factor, sub sieve methods of analysis, surface area determination.
Theory of screening and size distribution, different type of screening equipments , mesh number, cumulative screening, effectiveness factor, screening effectiveness. Vibrating feeders, trammel, Separation of solids

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

- **RECOMMENDED BOOKS**

Textbooks

1. Unit Operations of Chemical Engineering, W. L. McCabe & J.M. Smith, et al McGraw Hill Publication.
2. Chemical Engineering Vol.-I & II, J. F. Richardson J. M. Coulson, Pergamon Press Publication
3. Introduction to Chemical Engineering, W. L. Badger and J. T. Banchero McGraw Hill Publication.
4. Principles of Unit Operations, A. S. Foust et al John Wiley & Sons Publications.
5. Chemical Engineers Hand book, R. H. Perry, McGraw Hill Publication.
6. Mass Transfer Operation- Treybal
7. Absorption and extraction- Sherwood and Pigford
8. Unit operations of Chemical Engineering by W. L. McCabe and J. C. Smith, Mc Graw Hill

9. Unit operations by C.G.Brown

Reference Books

1. Perry's Chemical Engineers' Handbook. Eighth Edition by James O Maloney

- **PATTERN OF QUESTION PAPER**

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (I, II, III) and Section B questions on remaining three units (IV, V, VI). Question paper should cover the entire syllabus.

- **FOR 80 MARKS PAPER**

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least eight bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII

Course Code : BTD 453
Teaching Scheme
Theory: 04 Hours/Week

Title : NANOTECHNOLOGY (NT)

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ OBJECTIVES

1. To understand the concept, significance and scope of nanotechnology
2. To understand the various methods employed in preparation and analysis of nanomaterials
3. To understand and enable to apply the concepts of nanotechnology in varied biotechnological fields

COURSE CONTENTS

SECTION A

UNIT 1: INTRODUCTION TO NANOTECHNOLOGY (4 hrs)
Essence of Nanotechnology, Nano in daily life, Brief account of nano applications in different fields, dimentions of nanoparticles, properties of nano materials, advantages and disadvantages of nanoparticles.

UNIT 2: DIFFERENT CLASSES OF NANOMATERIALS (4 hrs)
Metal and Semiconductor Nanomaterials, Quantum Dots, Wells and Wires, Molecule to bulk transitions Bucky balls and Carbon Nanotubes.

UNIT 3: METHODS FOR PREPARATION OF NANOMATERIALS I (8 hrs)
Physical Methods (Inert gas condensation, Arc discharge, ball milling).
Chemical methods (Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, nanocrystals of semiconductors and other materials by arrested precipitation, emulsion synthesis, sonochemical routes)

SECTION B

UNIT 4: METHODS FOR PREPARATION OF NANOMATERIALS II (8 hrs)
Thermolysis route(spray pyrolysis and solvated metal atom dispersion, sol-gel method, solvothermal and hydrothermal routes, solution combustion synthesis, Chemical vapor synthesis).
Biological methods(use of bacteria, fungi, actinomycetes for nano-particle sythesis-magnetotatic bacteria for natural synthesis of magnetic nano-particle).

UNIT 5: CHARACTERIZATION (8 hrs)

UV-Visible spectroscopy, TEM, SEM and SPM technique, AFM. STM. XPS, X-ray, EDAX Fluorescence Microscopy and Imaging.

UNIT 6: APPLICATION (8 hrs)

Applications of nanobiotechnology in medicine, tissue engineering, diagnostic application, drug delivery application, food etc.

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

RECOMMENDED BOOKS

Textbooks

1. Inorganic Materials Synthesis and Fabrication by J.N. Lalena, D.A. Cleary, E.E. Carpenter, N.F. Dean, John Wiley & Sons Inc.
2. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens. Wiley India Pvt Ltd.
3. The Chemistry of nanomaterials: Synthesis, Properties and Applications, Vol-I by C.N.R. Rao, A. Muller and A.K. Cheetham
4. Textbook of Nanoscience and Nanotechnology. B.S. Murty, P. Shankar, Baldev Raj, B B Rath, James Murday

Reference books

1. Encyclopedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy, Vol I to X, Campus books.
2. Encyclopedia of Nanotechnology by H.S. Nalwa
3. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology – by T.Pradeep;
4. Tata Mc.Graw Hill
5. A.Nabok, "*Organic and Inorganic Nanostructures*", Artech House, 2005
6. Nanoscience: "*Nanotechnologies andNanophysics*", Springer-Verlag Berlin Heidelberg, 2007 by C.Dupas, P.Houdy, M.Lahmani

➢ PATTERN OF QUESTION PAPER

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (I, II, III) and Section B questions on remaining three units (IV, V, VI). Question paper should cover the entire syllabus.

➢ FOR 80 MARKS PAPER

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least eight bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks.

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII
Elective II

Course Code : BTD 491
Title : Bioethics, Biosafety And Intellectual Property Rights (BBIPR)

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

➢ OBJECTIVES

1. To understand the importance of Bioethics and Biosafety in Biotechnological practices.
2. To understand the concept of Intellectual Property Rights and its various forms.
3. To understand the implications of IPR in Biotechnology.

COURSE CONTENTS

SECTION A

UNIT 1: INTRODUCTION TO BIOETHICS AND BIOSAFETY (06 Hrs)

Concept and definition of bioethics, need of bioethics, applications of bioethics; biosafety – concept, definition, applications, levels and criteria of biosafety and overview of legal and socioeconomic impacts of biotechnology –biosafety regulations, risk versus benefits, hazardous materials used in biotechnology, GMP, GLP, GLPP.

UNIT 2: BIOETHICS RELATED TO HUMANS AND ANIMALS (07 Hrs)

Ethical issues of Human genome project, animal and human cloning and organ transplantation

UNIT 3: BIOETHICS IN GENETICALLY MODIFIED FOOD AND CROPS (07 Hrs)

Introduction, history, techniques and uses of genetic modifications, genetically modified food, its health implications, regulations of GM Food Technology, ethical issues associated with consumption of GM Food, WHO, labeling of GM products

SECTION B

UNIT 4: BIOETHICS IN STEM CELL (05 Hrs)

Definition, properties, hematopoietic stem cells, its uses, sources, clinical applications, stem cell in gene therapy, biosafety and ethical issues of stem cells

UNIT 5: INTELLECTUAL PROPERTY RIGHTS (10 Hrs)

Implications of IPR, WTO, GATT, history of Indian Patent system, patenting authorities, types and forms of IPR, Procedure involved in patent application and granting, patents in India, Patent search, PCT, TRIPS, compulsory licensing and its procedure

UNIT 6: PATENTING IN BIOTECHNOLOGY (05 Hrs)

Farmer's rights, plant breeder's rights, UPOV; Patening of living organism, bioethics in biodiversity, ethics in resource management, patenting of living organisms, case studies of patent applications in biotechnology- Harvard mouse, PCR, Hepatitis B, HIV protease inhibitors, embryonic stem cells, drug patenting in India

SECTION A: UNIT I, II, III

SECTION B: UNIT IV, V, VI

- RECOMMENDED BOOKS

Textbooks

1. Bioethics and Biosafety in Biotechnology by V Sree Krishna, New Age International Publications, (2007)
2. Bioethics and Biosafety by M. K Satcesh, I K International Publishing House, (2008)
3. Bioethics: An Introduction to the History, Methods and Practice, by Jecker Nancy S, Jonsen A R and Pearlson R A, Jones and Barlett Learning, LLC (2012)
4. Bioethics by Singh Shweta, RBSA Publishers

Reference books

1. The Cartagena protocol of Biosafety by Christoph Bail, Robert Falknar and Helen Marquard, Earthscan Publication (2002)
2. Transgenic Organism and Biosafety by E.R. Schmidt T. Hankeln, Springer Publication, 1996
3. Biosafety and Risk Assessment in Agricultural Biotechnology by Patricia L. Traynor, Robert Frederick and Muffy Koch 2002
4. Bioethics for Scientists by John A. Bryant, Linda Baggott la Velle, John F. Searle, Wiley Publication (2002)

➢ PATTERN OF QUESTION PAPER

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (I, II, III) and Section B questions on remaining three units (IV, V, VI). Question paper should cover the entire syllabus.

➢ FOR 80 MARKS PAPER

1. Minimum ten questions

2. Five questions in each section

3. Question no 1 and 6 be made compulsory and should have at least eight bits of two marks out of which FIVE to be solved.

4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks.

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII
Elective II

Course Code : BTD 492 Title : Process Modeling and simulation (PMS)

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

- **OBJECTIVES**
  1. Understanding mathematical basics of physical phenomenon
  2. Introduction of different numerical methods of analysis for describing observations
  3. Ability to solve modelling problems using different softwares

- **COURSE CONTENT**

SECTION A

Unit 1 :

Introduction to Modeling & Simulation, Definitions, different types of models, applications of modeling, scope of coverage. Approaches to simulation, design problems Vs simulation problems, information flow diagram in modeling, CAD package in Chemical Engg – Thermodynamic & physical properties package, module library, numerical routines library, costing, etc. (04Hrs)

Unit 2 :

Mathematical Models their classification (deterministic Vs stochastic, linear Vs nonlinear, lumped Vs distributed parameter, dynamic Vs steady state etc with examples), Model building and procedure for steady state & unsteady state models in mass transfer operations, heat transfer operations, fluid flow operations, reaction engineering. (06Hrs)

Unit 3 :

Fundamental laws and their applications – Equation of continuity, equation of motion, equation of energy, equation of state, equation of transport, phase & chemical equilibrium, chemical kinetics, etc. Solutions to systems of non-linear algebraic equations, Newton's & successive substitution, Euler

& Runge-Kutta method, Mode's of difference. Applications in chemical engg operations. (10Hrs)

Unit 4 :

Modeling and simulation of heat transfer & other equipments like DPHE, S&THE, evaporators, agitated vessels, mixing processes. fluid-solid operations, pressure change equipments etc. (06Hrs)

Unit 5 :

Modeling and simulation of mass transfer equipments used in flash distillation, continuous binary distillation, tray & packed column, vaporizers, single & multi phase separation, drying, adsorption, absorption & stripping. (08Hrs)

Unit 6 :

Modeling and simulation of reaction equipments like batch reactor, mixed flow reactor, plug flow reactor, trickle bed reactor, bubble column reactor, packed column reactor, fluid bed reactor, bioreactor, etc. (06Hrs)

Introduction to commercially available simulation package. Hysis, Hysis-Aspen, Simulink, Simusolve ect.

Reference Books :

1. Process Modeling, Simulation, and Control for Chemical Engineers, W. L. Luyben, McGraw Hill Pub. Co.

2. Process Plant Simulation, B.V. Babu, Oxford University Press.

3. Process Modeling & Simulation, R.W. Gaikwad, Dr. Dhirendra, Denett & Co.

4. Fundamentals & Modeling of Separation Processes, C D. Holland, Prentice Hall Inc., New Jersey.

5. Chemical Plant Simulation, Crowe, Heimlich, Hoffman, Johnson, S Hannou and Woods, McMaster University Publication.

6. Separation Process Principles, J D Seder and Henley

PATTERN OF QUESTION PAPER

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (I, II, III) and Section B questions on remaining three units (IV, V, VI). Question paper should cover the entire syllabus.

- **FOR 80 MARKS PAPER**

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least eight bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weightage of 15 marks.

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FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII
Elective II

Course Code : BTD 493 Title : Open elective

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks) : 80 Marks
Theory Examination (Duration) :03 Hours

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FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII

Course Code : BTD 471 Title :- Advanced Genetic Engineering Lab

Teaching Scheme
Practical: 04 Hours/Week

Examination Scheme
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration) :- 04 Hours
Term Work: 25 Marks

➢ PRACTICALS

1. DNA Amplification using PCR
2. SDA PAGE
3. Native PAGE
4. Randomly Amplified polymorphic DNA markers in plant variety identification
5. ISSR markers in varietal identification
6. SSR markers in varietal identification
7. Cloning of genomic DNA or PCR product in the host bacterium
8. Southern blotting
9. Multiporation
10. Cell fusion by chemical methods

➢ PATTERN OF PRACTICAL EXAMAMINATION

Minimum 6 practical's should be conducted from the above list. The practical examination shall consist of performing an experiment based on the practical work done during the course i.e. one major and one minor experiment during examination, the record of the experiments submitted by the candidate and viva-voce based on the syllabus.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII

Course Code : BTD 472 Title :- Unit Operations Lab

Teaching Scheme	Examination Scheme
Practical: 02 Hours/Week	Practical /Oral Examination: 50 Marks
	Practical /Oral Examination (Duration) :- 04 Hours
	Term Work: 25 Marks

➢ PRACTICALS

1. Sieve analysis 2. Vibrating Screen
3. Jaw crusher 4. Pulveriser
5. Ball mill 6. Batchsettling
7. Sedimentation 8. Diffusion
9. Mass transfer coefficient
10. Batch Drying 11. Tie line extraction
12. Crystallization 13. Solid-Liquid extraction
14. Distillation

➢ PATTERN OF PRACTICAL EXAMAMINATION

Minimum 8 practical's should be conducted from the above list. The practical examination shall consist of performing an experiment based on the practical work done during the course i.e. one experiment during examination, the record of the experiments submitted by the candidate and viva-voce based on the syllabus.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FINAL YEAR ENGINEERING (BTD)
SEMESTER VIII

Course Code : - BTD 473 **Title :- Project Part II**

Teaching Scheme
Practical: 04 Hours/Week

Examination Scheme
Practical /Oral Examination: 100 Marks
Practical /Oral Examination (Duration) :- 04 Hours
Term Work: 100 Marks

1. The guide should be internal examiner for oral examination.
2. The external examiner should be from the related area of the concerned project. He should have minimum of five years of experience at degree level / industry.
3. The evaluations at final oral examination should be done jointly by the internal and external examiner.
4. The same project group of Part I should continue the work in Part – II as well. The project group should complete the project work taken in Part I. The final examination will consist of the demonstration of work which will be judged by two examiners (one internal and one external) and the marks will be given accordingly.
5. Only one report should be submitted per group as a part of term work submission
6. The suggestive format of the report is as given below, however any detailed format as given by the department and which is inline with any peer reviewed Journal can also be considered.

   Names & Roll Numbers of the students:

   Name of the guide:

   Chapter 1: Introduction

   Chapter 2: Literature Survey

   Chapter 3: Materials and Methods

   Chapter 4: Results and Discussion

   Chapter 5: Conclusions