ANNA UNIVERSITY CHENNAI::CHENNAI 600 025
CURRICULUM 2004
B.Tech. BIOTECHNOLOGY
FIRST YEAR – ANNUAL PATTERN
(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
HS1X01	Technical English	3	0	0	100
MA1X01	Engineering Mathematics – I	3	1	0	100
PH1X01	Engineering Physics	3	0	0	100
CY1X01	Engineering Chemistry	3	0	0	100
GE1X04	Engineering Mechanics	3	1	0	100
BT1X01	Biochemistry – I	3	0	0	100
GE1X01	Engineering Graphics	3	0	0	100
GE1X02	Computer Programming	2	0	2	100
PRACTICAL					
PC1X01	Physics & Chemistry Laboratory	0	0	3	100
GE1X03	Engineering Practices Laboratory	0	0	2	100

SEMESTER – III

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MA1201	Mathematics III	3	1	0	100
BT1201	Principles of Chemical Engineering	3	0	0	100
CY1201	Environmental science and Engineering	3	0	0	100
BT1202	Cell Biology	3	0	0	100
BT1203	Bioorganic Chemistry	3	0	0	100
BT1204	Microbiology	3	0	0	100
PRACTICAL					
BT1152	Bio Chemistry Lab	0	0	4	100
BT1205	Bioorganic Chemistry Lab	0	0	4	100
BT1206	Cell Biology Lab	0	0	4	100

SEMESTER – IV

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
BT1251	Basic Industrial Biotechnology	3	0	0	100
MA1255	Probability & Statistics	3	1	0	100
BT1252	Unit Operations	3	0	0	100
BT1253	Chemical Thermodynamics & Biothermodynamics	3	0	0	100
BT1254	Instrumental Methods of Analysis	3	0	0	100
BT1255	Molecular Biology	3	0	0	100
PRACTICAL					
BT1207	Microbiology Lab	0	0	4	100
BT1256	Instrumental Method of Analysis Lab	0	0	4	100
BT1258	Chemical Engg. Lab	0	0	4	100

SEMESTER – V

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
GE1301	Professional Ethics & Human values	3	0	0	100
BT1301	Enzyme Engg. & Technology	3	0	0	100
BT1302	Biochemistry II	3	0	0	100
BT1303	Bioprocess Principles	3	0	0	100
BT1304	Mass Transfer operations	3	0	0	100
BT1305	Genetic Engineering	2	1	0	100
PRACTICAL					
BT1257	Molecular Biology Lab	0	0	4	100
BT1306	Bioprocess Lab - I	0	0	4	100
GE1302	Communication Skills & Seminar**	0	0	2	-

SEMESTER – VI

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
BT1351	Bio informatics	3	0	0	100
BT1352	Chemical Reaction Engineering	3	0	0	100
BT1353	Bioprocess Engineering	3	0	0	100
BT1354	Protein Engineering	3	0	0	100
E1***	Elective I	3	0	0	100
E2***	Elective II	3	0	0	100
PRACTICAL					
BT1307	Genetic Engg. Lab	0	0	4	100
BT1355	Bioprocess Lab II	0	0	6	100
GE1351	Presentation Skills & Seminar**	0	0	2	-

SEMESTER – VII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MG1351	Principles of Management	3	0	0	100
E3***	Elective III	3	0	0	100
BT1401	Downstream processing	3	1	0	100
BT1402	Immunology	3	1	0	100
E4***	Elective IV	3	0	0	100
E5***	Elective V	3	0	0	100

PRACTICAL					
BT1403	Analytical Techniques in Biotechnology	0	0	6	100
BT1404	Dowmstream processing Lab	0	0	4	100
BT1405	Immunology Lab	0	0	4	100

SEMESTER – VIII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

Code No.	Course Title	L	T	P	M
THEORY					
MG1401	Total Quality Management	3	0	0	100
E6***	Elective VI	3	0	0	100
PRACTICAL					
BT1451	Project Work	0	0	6	200

**** No Examinations**

LIST OF ELECTIVES

ELECTIVES – I

Code No.	Course Title	L	T	P	M
BT1001	Environmental Biotechnology	3	0	0	100
BT1002	Plant Biotechnology	3	0	0	100
CH1355	Process Instrumentation Dynamics & Control	3	0	0	100

ELECTIVES – II

Code No.	Course Title	L	T	P	M
BT1004	Bio Conjugate Technology				
BT1005	Animal Biotechnology	3	0	0	100
BT1006	Principles of Food Processing	3	0	0	100

ELECTIVES – III

Code No.	Course Title	L	T	P	M
BT1007	Process Equipments & Plant Design	3	0	0	100
BT1008	Biophysics	3	0	0	100
BT1009	Cancer Biology	3	0	0	100

ELECTIVES – IV

Code No.	Course Title	L	T	P	M
BT1010	Biopharmaceutical Technology	3	0	0	100
BT1011	Immunotechnology	3	0	0	100
BT1012	Biological Spectroscopy	3	0	0	100

ELECTIVES – V

Code No.	Course Title	L	T	P	M
BT1013	Molecular Modeling & Drug Design	3	0	0	100

BT1014	Molecular Pathogenesis	3	0	0	100
BT1015	Metabolic Engineering	3	0	0	100

ELECTIVES – VI

Code No.	Course Title	L	T	P	M
BT1016	Genomics & Proteomics	3	0	0	100
BT1017	Neurobiology & Cognitive Sciences	3	0	0	100
BT1018	Bioprocess Economics & Plant Design	3	0	0	100

MA1201 MATHEMATICS III 3 1 0 100

AIM

The course aims to develop the skills of the students in the areas of boundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

OBJECTIVES

At the end of the course the students would

- Be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization on Fourier transform pair, their properties, the possible special cases with attention to their applications.
- Have learnt the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9 + 3

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9 + 3

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

TUTORIAL 15

TOTAL : 60

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company Ltd., New Delhi, 1996.

REFERENCES

1. Wylie C. Ray and Barrett Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, Inc., New York, 1995.
2. Andrews, L.A., and Shivamoggi B.K., "Integral Transforms for Engineers and Applied Mathematicians," Macmillen, New York, 1988.
3. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.

BT1201 PRINCIPLES OF CHEMICAL ENGINEERING 3 0 0 100

AIM

The course aims to develop skills of the Students in the area of Chemical Engineering with emphasis in Thermodynamics fluid mechanics. This will be necessary for certain other course offered in the subsequent semesters and will serve as a prerequisite.

OBJECTIVES

At the end of the course the students would have gained knowledge in Mass and Energy Conservation, Laws of Thermodynamics and Principles of Fluid Mechanics. This will help him to understand certain subjects of Engineering offered in this programme.

UNIT I OVERVIEW OF PROCESS INDUSTRY 8

Mass and energy conservation; process automation; environment; SI units; conservation factors; applied mathematics for experimental curve fitting; numerical differentiation; integration.

UNIT II MATERIAL BALANCES 10

Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; unit operations; recycle and by pass; humidity calculations.

UNIT III FIRST AND SECOND LAWS OF THERMODYNAMICS 9

Energy balances; sensible heat, latent heat; vapour pressure; steady and unsteady state calculations.

UNIT IV FLUID MECHANICS 10

Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts; multiphase flow concepts.

UNIT V FLOW THROUGH PACKED COLUMNS 8

Fluidisation; centrifugal and piston pumps; characteristics; compressors; work.

TOTAL : 45

TEXT BOOKS

1. Bhatt B.I., Vora S.M. Stoichiometry. 3rd Edition. Tata McGraw-Hill, 1977.
2. McCabe W.L., Smith J.C, Harriot P. "Unit Operations In Chemical Engineering", 5th Edition. McGraw-Hill Inc., 1993.

REFERENCE

1. Geankoplis C.J. "Transport Processes and Unit Operations", Prentice Hall India, 2002.

CY1201 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 100

(Common to all branches)

OBJECTIVES

- To create an awareness on the various environmental pollution aspects and issues.
- To give a comprehensive insight into natural resources, ecosystem and biodiversity.
- To educate the ways and means to protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: use effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

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 – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – urban / rural / industrial / agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

TEXT BOOKS

1. Gilbert M .Masters, “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., “Environmental Science”, Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, “The Biodiversity of India”, Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Trivedi R.K., “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, “Environmental Encyclopedia”, Jaico Publ., House, Mumbai, 2001.
4. Wager K.D. “Environmental Management”, W.B. Saunders Co., Philadelphia, USA, 1998.
5. Townsend C., Harper J and Michael Begon, “Essentials of Ecology, Blackwell Science.
6. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications.

BT1202 CELL BIOLOGY 3 0 0 100

AIM

The course aims to develop skills of the Students in the area of Cell Biology and Cell Signalling pathways. This will be necessary for studies in course like Microbiology, Molecular course is also a prerequisite for other Biology, etc., This courses offered in the subsequent semesters.

OBJECTIVES

At the end of the course, the students would have gained extensive knowledge in cell culture, cell signaling pathways Transfer across membranes. This will be helpful for courses like Biophysics, Proteins Engg. etc.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9

Eukaryotic and prokaryotic cells, principles of membrane organisation, membrane proteins, cytoskeletal proteins, types of cell division, mitosis & meiosis, extra cellular matrix, cell cycle and molecules that control cell cycle.

UNIT II TRANSPORT ACROSS CELL MEMBRANES 9

Passive & active transport, permeases, sodium potassium pump, Ca2+ ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, co transport symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis. Entry of viruses and toxins into cells.

UNIT III RECEPTORS AND MODELS OF EXTRA CELLULAR SIGNALLING 9

Cytosolic, nuclear and membrane bound receptors, examples of receptors, autocrine, paracrine and endocrine models of action, quantitation and characterisation of receptors.

UNIT IV SIGNAL TRANSDUCTION 9

Signal amplification, different models of signal amplifications, cyclic amp, role of inositol phosphates as messengers, biosynthesis of inositol tri phosphates, cyclic GMP and g proteins, role in signal transduction, calcium ion flux and its role in cell signaling, current models of signal amplification, phosphorylation of protein kinases, regulation of protein kinases, serine –threonine kinases, tumor necrosis factor receptor families.

UNIT V CELL CULTURE 9

Techniques for the propagation of eukaryotic and prokaryotic cells. Cell line, generation of cell lines, maintenance of stock cells, characterization of cells, immunochemistry, morphological analysis techniques, in cell culture, ex-plant cultures primary cultures, contamination, differentiation, three dimensional cultures, role of matrix in cell growth.

TOTAL : 45

TEXT BOOKS

1. Darnell J, Lodish H, Baltimore D, “Molecular Cell Biology”, W.H.Freeman;
2. Kimball T.W., “Cell Biology”, Wesley Publishers;

REFERENCES

1. De Robertis & De Robertis, “Cell Biology”.
2. James D.Watson, “Molecular Biology of the Cell”.

BT1203 BIOORGANIC CHEMISTRY 3 0 0 100

AIM

The course aims to develop skills of Students in the area of Organic Chemistry and its applications in Biology. This will be a prerequisite to courses like Molecular Modelling, Bioseparations etc.

OBJECTIVES

At the end of the course the students would have gained in depth knowledge in Stereochemistry, Stereochemistry of enzyme reactions and Protein folding. This knowledge will be very helpful for learning other subjects in subsequent semesters.

UNIT I CONCEPTS IN ORGANIC CHEMISTRY 9

Stereochemistry – R,S notation – re-si faces – e,z isomerism- conformers- ethane – cyclopean - reactivates- mechanisms of sn1 sn2 reactions, e1 e2 reactions – ester formation and hydrolysis, reaction rates - hammond's postulate – h/d effects. Catalysis – general acid – base and covalent catalysis.

UNIT II STEREOCHEMISTRY OF ENZYMATIC REACTIONS 9

Stereospecific enzymatic reactions – fumarase catalysed reactions – NAD dependent oxidation and reduction reactions - Stereochemistry of nucleophilic reactions – chiral methyl group – chiral phosphate.

UNIT III CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM 9

The dehydrogenases – the proteases – ribonucleases – lysozyme- stability of proteins – stability – activity tradeoff.

UNIT IV KINETICS OF PROTEIN FOLDING 9

Basic methods – two state kinetics – multistate kinetics – transition states in protein folding – 1h/2h exchange methods – folding of peptides.

UNIT V FOLDING PATHWAYS & ENERGY LANDSCAPES 9

Folding of ci2 – nucleation condensation mechanism – folding of barnase – time resolution – insights from theory – optimization of folding rates – molecular chaperones.

TOTAL : 45

REFERENCES

1. Structure And Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A. R. Fersht, W.H. Freeman, 1999.
2. Bioorganic Chemistry; H. Dugas, Springer Verlag, 1999.

BT1204 MICROBIOLOGY 3 0 0 100

AIM

The course aims to develop skills of the Students in the area of Microbiology particularly to identify microbes, their structure, their metabolism and their industrial applications. This will be a prerequisite for all courses offered in Bioprocess Technology.

OBJECTIVES

At the end of the course the students would have learnt about all types of microorganisms, their growth characteristics and their industrial uses. This will be very helpful to students when they undertake project work in Biotechnology.

UNIT I INTRODUCTION 6

Basic of microbial existence; history of microbiology, classification and nomenclature of microorganism, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES-STRUCTURE AND MULTIPLICATION 12

Structural organization and multiplication of bacteria, viruses, algae and fungi with a special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophage.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 12

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve and different methods to quantitate bacterial growth, aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT - IV CONTROL OF MICROORGANISMS 6

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents, mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT - V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY 9

Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vit.b-12; biogas; bioremediation; leaching of ores by microorganisms; bio-fertilizers and bio-pesticides; microorganisms and pollution control; biosensors

TOTAL : 45

TEXT BOOKS

1. Talaron K, Talaron A, Casita, Pelczar And Reid. Foundations In Microbiology, W.C.Brown Publishers, 1993.
2. Pelczar MJ, Chan ECS and Krein NR, Microbiology, Tata McGraw-Hill Edition, New Delhi, India.
3. Prescott LM, Harley JP, Klein DA, Microbiology, 3rd Edition, Wm. C. Brown Publishers, 1996.

BT1205 BIO ORGANIC CHEMISTRY LAB 0 0 4 100

AIM

The course aims is offering hands on training in the area of Bio Organic Chemistry. This will be a prerequisite for certain lab courses offered in the subsequent semesters and also for the project work.

OBJECTIVES

At the end of the course the students would have learnt the methodology of synthesis of materials / that are used in Pharma & Biotech industries. This knowledge can be applied in their project work also.

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid from tartaric acid
4. Preparation of oleic acid from tartaric acid
5. Preparation of alpha d- glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexylnoine alpha d glucofuranose
7. Isolation of lycopene from tomato paste
8. Preparation of l-proline
9. Preparation of l-cysteine from hair
10. Preparation of s-ethyl hydroxybutonate from ethyl acetoacetate using yeast
11. Resolution of s-ethyl hydroxybutonate using 3,5 dinitrobenzoate.
12. Preparation of 5,10,15,20-tetrakisphenyl porphyrin.

TOTAL : 45

REFERENCE

1. Fummis B.S., Hannaford A.J., Smith P.W.G., “Text Book of Practical Organic Chemistry”, Longman Edition, 1995.

BT1206 CELL BIOLOGY LAB 0 0 4 100

AIM

The course aims is offering hands on training in the area of Cell culture and Cell identification. This will serve as a prerequisite for post graduate and specialized studies & research.

OBJECTIVES

At the end of the course from various sources, the students would have learnt the methodology to isolate cells & to identify them by specialized work microscopy. This will be extremely beneficial to take up project work in cellular biology.

1. Introduction to principles of sterile techniques and cell propagation.
2. Principles of microscopy, phase contrast and fluorescent microscopy.

3. Identification of given plant, animal and bacterial cells and their components by microscopy,
4. GRAM'S Staining,
5. Leishman Staining,
6. Thin Layer Chromatography,
7. Giemsa Staining,
8. Separation of Peripheral Blood Mononuclear Cells from blood,
9. Osmosis and Tonicity,
10. Tryphan Blue Assay,
11. Staining for different stages of mitosis in AlliumCepa (Onion).

TOTAL : 45

BT1207 MICROBIOLOGY LAB 0 0 4 100

AIM

The course aims to develop the skills of students in area of microbiology. Here hands on training is offered for the students to study microbes, their identifications & characterization and their practical uses.

OBJECTIVES

At the end of the course the student would have learnt about the culturing of microorganism, their identification using simple staining techniques. Thus this hands on training will be very beneficial for them to undertake project work in the later semesters.

1. Laboratory safety and sterilization techniques
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. Culturing of microorganisms – in broth and in plates (pour plates, streak plates, isolation and preservation of bacterial cultures)
5. Staining techniques – grams' and differential
6. Quantitation of microorganisms.
7. Effect of disinfectants on microbial flora
8. Isolation and identification of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve – observation and growth characteristics of bacteria and yeast.
11. Effect of different parameters on bacterial growth (ph, temperature & UV irradiation)

BT1251 BASIC INDUSTRIAL BIOTECHNOLOGY 3 0 0 100

AIM

The course aims to develop skills of the Students in area of Basic Industrial Biotechnology. This will be very effect in understanding courses like Bioprocess technology, genetic engineering. Etc.,

OBJECTIVES

At the end of the course the students would have learnt about production of primary & secondary metobolites, enzymes, vaccines on an industrial scale. This will be very beneficial for certain specialised courses & project work.

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS 7

A historical overview of industrial fermentation process – traditional and modern biotechnology. A brief survey of organisms, processes, products relating to modern biotechnology. Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES 10

A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc.,); amino acids (glutamic acid, phenyalanine, aspartic acid etc.,) and alcohols (ethanol, butanol etc.,)

UNIT III PRODUCTION OF SECONDARY METABOLITES 10

Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin etc.), aminoglycosides (streptomycin etc.,) macrolides (erythromycin), vitamins and steroids.

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 8

Production of industrial enzymes such as proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilisers, biopreservatives (Nisin), cheese, biopolymers (xanthan gum, PHB etc.,), single cell protein.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 10

Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture.

TOTAL : 45

TEXT BOOKS

1. Casida Jr, L.E., "Industrial Microbiology", New Age International (P) Ltd.
2. Presscott, Dunn, "Industrial Microbiology", Agrobios (India).

REFERENCES

1. Wulf Cruger and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", Panima Publishing Corporation.
2. Murrey Moo & Young, "Comprehensive Biotechnology", Pergamon.

REVISED

MA1255 PROBABILITY AND STATISTICS 3 1 0 100

AIM

The Scope of probability and statistics in engineering applications is well known.

This course aims at providing the requisite skill to apply the statistical tools in Engineering

problems.

OBJECTIVES

At the end of the course, the students would,

- Have a fundamental knowledge of the basic probability concepts
- Acquire skills in handling situations involving more than one random variable and functions of random variable
- Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

1. PROBABILITY AND RANDOM VARIABLES 9

Probability concepts, random variables, moment, moment generating function, binomial, Poisson, geometric, negative binomial, exponential, gamma, weibull distributions, functions of random variable, chebychev inequality.

2. TWO-DIMENSIONAL RANDOM VARIABLES 9

Marginal and conditional distributions, covariance, correlation and regression, transformation of random variables, central limit theorem.

3. RANDOM PROCESS 9

Classification, stationary and markov processes, Poisson process, pure birth process, birth and death process, markov chains, markovian queueing models.

4. RELIABILITY ENGINEERING 9

Concepts of reliability, hazard function, series and parallel systems, reliability and availability of markovian systems, maintainability, preventive maintenance.

5. DESIGN OF EXPERIMENTS AND QUALITY CONTROL 9

Completely randomised design, randomised block design, latin square design, process control, control charts of measurements and attributes, tolerance limits.

TUTORIAL 15

TOTAL : 60

TEXT BOOKS

1. Mille I.R. And Freund J.E., “Probability And Statistics For Engineers”, Prentice-Hall, 1995.
2. Kapur J.N. And Saxena H.C., “Mathematical Statistics”, S Chand and Company Ltd., New Delhi, 1997.

REFERENCES

1. Balagurusamy E., “Reliability Engineering”, Tata McGraw-Hill Publishers, New Delhi, 1984.
2. Bhat U.N., “Elements Of Applied Stochastic Processes”, Wiley Series In Probability And Mathematical Statistics, New York, 1983.

BT1252 UNIT OPERATIONS 3 0 0 100

AIM

The course aims to develop skills of the Students in area of unit operations. This course will be a prerequisite for certain engineering subjects offered in the subsequent semesters.

OBJECTIVES

At the end of the course the students would have learnt about techniques like mixing, Agitation, Filtration, Heat transfer & Heat exchangers. Thus this will be very useful for the student to study specialized courses in engineering offered in the subsequent semesters.

UNIT I MIXING AND AGITATION 8

Dimensional analysis; power for agitation; agitation of liquids; gas-liquid systems; gas-solid suspensions; agitator scale up.

UNIT II FILTRATION 8

Constant pressure, constant volume batch filtration; continuous filtration; industrial filters; settling and sedimentation; centrifugation.

UNIT III MECHANISM OF HEAT TRANSFER 10

Steady state conduction; combined resistances; unsteady state conduction; lumped heat capacity; extended surfaces; combined conduction and convection.

UNIT IV CONVECTION HEAT TRANSFER 10

Dimensional analysis; forced and natural convection; convection in flow over surfaces through pipes boiling and condensation.

UNIT V HEAT EXCHANGERS 9

Equipments; overall heat transfer coefficients; design of heat exchangers; NTU concept; evaporators; single and multiple effects; mass and enthalpy balances.

TOTAL : 45

TEXT BOOKS

1. Geankoplis C.J. Transport Processes And Unit Operations. Prentice Hall India.2002.
2. McCabe W.L., Smith J.C. Unit Operations In Chemical Engineering.5th Edition.Mcgrawhill.1993.

REFERENCE

1. Incropera F.P. Fundamentals Of Heat And Mass Transfer. John Wiley.1998.

BT1253 CHEMICAL THERMODYNAMICS AND BIOTHERMODYNAMICS 3 0 0 100

AIM

The course aims to expose the students to the area of chemical thermodynamics & Biothermodynamics. This will serve as a prerequisite for courses like enzyme engineering, Mass transfer, etc.

OBJECTIVES

At the end of the course the students would have learnt about thermodynamic properties of fluids, Chemical potential, fugacity, Gibbs-Duhem equation, Phase equilibria etc. The knowledge gained in this course will be very useful for studying certain specialized subjects offered in later semesters.

UNIT I THERMODYNAMIC PROPERTIES OF FLUIDS 9

Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications.

UNIT II SOLUTION THERMODYNAMICS 9

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

UNIT III PHASE EQUILIBRIA 9

Criteria for phase equilibria; v-l-e calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

UNIT IV CHEMICAL REACTION EQUILIBRIA 9

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

UNIT V THERMODYNAMIC ANALYSIS OF PROCESSES 9

Concept of lost work; entropy generation; calculation of real irreversible processes; power cycle; liquefaction.

TOTAL : 45

TEXT BOOKS

1. Smith J.M., Van Ness H.C., Abbot M.M. Chemical Engineering Thermodynamics. 6th Edition. McGraw-Hill, 2001.
2. Narayanan K.V. A Text Book Of Chemical Engineering Thermodynamics. Prentice Hall India, 2001.

REFERENCES

1. Sandler S.I. Chemical And Engineering Thermodynamics. John Wiley, 1989.

BT1254 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 100

AIM

The course aims to develop the skills of the students in the area of Instrumentation in Biotechnology. This will be prerequisite for understanding specialized courses & project work that will be offered in the subsequent semesters.

OBJECTIVES

At the end of the course the students would have learnt about the working principles of optical methods, spectroscopy, thermal & separation methods used in Biotechnology. This will be useful the project work.

UNIT I BASICS OF MEASUREMENT 5

Classification of methods – calibration of instrumental methods – electrical components and circuits – signal to noise ratio – signal – noise enhancement.

UNIT II OPTICAL METHODS 5

General design – sources of radiation – wavelength selectors – sample containers – radiation transducers – types of optical instruments – Fourier transform measurements.

UNIT III MOLECULAR SPECTROSCOPY 15

Measurement of transmittance and absorbance – beer's law – spectrophotometer analysis – qualitative and quantitative absorption measurements - types of spectrometers – UV – visible – IR – Raman spectroscopy – instrumentation – theory.

UNIT IVTHERMAL METHODS 5

Thermo-gravimetric methods – differential thermal analysis – differential scanning calorimetry.

UNIT V SEPARATION METHODS 15

Introduction to chromatography – models – ideal separation – retention parameters – van – deemter equation – gas chromatography – stationary phases – detectors – kovats indices – HPLC – pumps – columns – detectors – ion exchange chromatography – size exclusion chromatography – supercritical chromatography – capillary electrophoresis

TOTAL : 45

TEXT BOOKS

1. Instrumental Methods of Analysis; Willard and .H. Merrit, Phi, 1999.
2. Instrumental Methods of Analysis, D. Skoog, 2000.

BT1255 MOLECULAR BIOLOGY 3 0 0 100

AIM

The course aims to develop skills of students in the area of Molecular Biology. This will serve as a pre-requisite for courses like Genetic Engg., Downstream processing etc.

OBJECTIVES

At the end of the course the students would have learnt about classical genetics, structure of nucleic acids, DNA replication, and how gave expression is regulated. This knowledge will be very heavy for students to study specialized subjects in modern biology & biotechnology.

UNIT I CLASSICAL GENETICS 5

Mendelian genetics, linkage, crossing over, classical experiments – Hershey and chase; Avery McLeod & McCarty. Bacterial conjugation, transduction and transformation.

UNIT II STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION 15

Conformation of DNA and RNA; replication in prokaryotes, D-loop and rolling circle mode of replication, replication of linear viral DNA. Organisation of eukaryotic chromosome – cot value, replication of telomeres in eukaryotes.

UNIT III TRANSCRIPTION 8

In prokaryotes and eukaryotes, features of promoters and enhancers, transcription factors, nuclear RNA splicing, ribozyme.

UNIT IVTRANSLATION 10

Elucidation of genetic code, mechanism, codon usage, suppressor mutation.

UNIT - V REGULATION OF GENE EXPRESSION 7

Lac and trp operon, □phage life cycle, mutation and repair of DNA

TOTAL : 45

TEXT BOOKS

1. David Friefelder, Molecular Biology, Narosa Publ. House. 1999
2. Benjamin Lewin, Gene VII, Oxford University Press. 2000

REFERENCE

1. Watson JD, Hopkins WH, Roberts JW, Steitz JA, Weiner AM, Molecular Biology of the Gene. 1987.

BT1256 INSTRUMENTAL METHODS OF ANALYSIS LAB 0 0 4 100

AIM

To develop skills of students by providing hands on training in using various equipments used in biotechnology. This will be a pre-requisite for certain specialized project work that a student undertakes.

OBJECTIVES

At the end of this laboratory course, the students would have learnt about spectroscopy, nephelometry & chromatography. In addition the student will also gain knowledge of operating these equipments.

1. Precision and validity in an experiment using absorption spectroscopy.
2. Validating Lambert-Beer's law using kmno4
3. Finding the molar absorbtivity and stoichiometry of the Fe (1, 10 phenanthroline) 3 using absorption spectrometry.
4. Finding the pKa of 4-nirophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferri oxolate.
7. Estimation of SO-4 by nephelometry.
8. Estimation of AL3+ by flourimetry.
9. Limits of detection using aluminum alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

BT1257 MOLECULAR BIOLOGY LAB 0 0 4 100

AIM

To develop the skills of the students by providing hands on training practical training in Molecular Biology. This will facilitate the students to take up specialized project in Molecular biology and will be a pre-requisite for research work.

OBJECTIVES

At the end of this course, the students would have learnt basic techniques used in Molecular Biology and its application. This will be strength for students to undertake research projects in the area of moderabiology.

1. Isolation of bacterial DNA
2. Isolation of plant cell and animal cell genomic DNA
3. Agarose gel electrophoresis
4. Restriction enzyme digestion
5. Competent cells preparation
6. Transformation and screening for recombinants
7. Agarose gel electrophoresis
8. Restriction enzyme digestion
9. Competent cells preparation
10. Blue and white selection for recombinants
11. Plating of Ọphage
12. Ọ phage lysis of liquid cultures

BT1258 CHEMICAL ENGINEERING LAB 0 0 4 100

AIM

To develop skills of students by providing hands on training in some of the aspects of chemical engineering. This will be a pre-requisite for lab courses in Bioprocess.

OBJECTIVES

At the end of the course, the student would have learnt about filtration, Distillation, Extraction procedures and how to perform them. This will be very useful for specialized project work that the students undertake in the subsequent semesters.

1. Flow measurement
2. Pressure drop in pipes and packed columns
3. Fluidization
4. Filtration
5. Heat exchanger
6. Simple and steam distillation
7. Distillation in packed column
8. Liquid-liquid equilibria in extraction
9. Adsorption equilibrium

GE1301 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 100
(Common to all branches)

AIM : To impart knowledge on moral issues.

OBJECTIVE

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of others

UNIT I HUMAN VALUES 10

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of "Engineering Ethics"' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies.
Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 8

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

TOTAL : 45

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

BT1301 ENZYME ENGINEERING AND TECHNOLOGY 3 0 0 100

AIM

To develop skills of students in the area of Enzyme engineering and technology. This will serve as a pre-requisite for courses in Bioprocess technology, Downstream processing etc to be offered in the subsequent semesters.

OBJECTIVES

At the end of the course the student would have learnt about enzymes, their mode of action, Kinetics of enzyme action and techniques like enzyme immobilization, purification of enzymes & Biosensors. This knowledge gained through this course will be helpful for project work in the later semesters.

UNIT I INTRODUCTION TO ENZYMES 9

Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; principles of catalysis – collision theory, transition state theory; role of entropy in catalysis.

UNIT II KINETICS OF ENZYME ACTION 12

Kinetics of single substrate reactions; estimation of Michelis – Menten parameters, multi substrate reactions- mechanisms and kinetics; turnover number; types of inhibition & models –substrate, product. Allosteric regulation of enzymes, Monod changeux wyman model, ph and temperature effect on enzymes & deactivation kinetics.

UNIT III ENZYME IMMOBILIZATION 8

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages.

UNIT IV PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES 8

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays.

UNIT - V ENZYME BIOSENSORS 8

Application of enzymes in analysis; design of enzyme electrodes and their application as biosensors in industry, healthcare and environment.

TOTAL : 45

TEXT BOOKS

1. Harvey W. Blanch, Douglas S. Clark, “Biochemical Engineering”, Marcel Dekker, Inc.
2. James M. Lee, “Biochemical Engineering”, PHI, USA.

REFERENCES

1. James. E. Bailey & David F. Ollis, “Biochemical Engineering Fundamentals”, McGraw-Hill.
2. Wiseman, “Enzyme Biotechnology”, Ellis Horwood Pub.

BT1302 BIOCHEMISTRY-II 3 0 0 100

AIM

To develop skills of the students in Biochemistry with special emphasis on the metabolizing amino acids, nucleic acids, polysaccharide & lipids and an bio membranes. This may be a pre-requisite for certain-elective courses like Metabolic Engineering; Molecular Modelling & Drug Design etc.

OBJECTIVES

At the end of the course, the student would have gained an extensive knowledge of Biochemistry particular various metabolic pathways & Biomembranes. This knowledge will be useful for project work.

UNIT I METABOLISM OF AMINO ACIDS 15

Nitrogen metabolism and urea cycle. Biosynthesis of Gly, Ser and Cys; Biosynthesis of six essential amino acids (Met, Thr, Lys, Ile, Val, Leu) and regulation of branched chain amino acids (concerted inhibition, allosteric regulation and enzyme multiplicity, sequential feed back) from oxaloacetate and pyruvate; Biosynthesis of aromatic amino acids. Metabolic disorders associated with branched chain and aromatic amino acid degradation. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc)

UNIT II PROTEIN TRANSPORT AND DEGRADATION 5

Protein targeting, signal sequence, secretion; Folding, Chaperons and targeting of organelle proteins, Protein degradation, receptor-mediated endocytosis, turnover.

UNIT III METABOLISM OF NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS 10

Biosynthesis of nucleotides, *denovo* and salvage pathways for purines and pyrimidines, regulatory mechanisms: Degradation of nucleic acid by exo and endo nucleases. Biosynthesis and degradation of starch and glycogen, Biosynthesis and degradation of Lipids: Fatty acid synthesis and oxidative degradation, Triacylglycerol and phospholipid biosynthesis and degradation; Cholesterol biosynthesis and regulation and targets and action of cholesterol lowering drugs. Vitamins (fat and water-soluble), Co-enzymes, hormones (steroids like corticoids, amino acids derived like adrenaline and noradrenaline and peptides like insulin and growth hormone).

UNIT IV STRUCTURAL PROTEINS AND CYTOSKELETON 5

Contractile proteins, Actin, myosin, actin polymerization, acto-myosin complexes, mechanism of myosin ATPase activity, excitation- contraction coupling and relaxation, microtubules, microfilaments and their role in organelle movements

UNIT V BIOMEMBRANE, TRANSPORT AND ELECTRICAL CONDUCTIVITY 10

Micelles, lipid bi-layer structure of membranes, membrane proteins, passive, career-mediated and active transport, ion-selective channels, trans-membrane potential coupled ATP generation, receptors, acetylcholine receptor as a ligand gated ion-channel, Neuronal sodium channel as voltage-gated ion channel, neurotransmitters and their mechanism of action, action potential, depolarization and nerve conduction. Ion-channel agonists and antagonists as drugs. Ion channel defects (Cystic Fibrosis)

TOTAL : 45

TEXT BOOKS

1. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M Cox, Macmillan Worth Publisher
2. Lubert Stryer, Biochemistry, 4th Edition, WH Freeman & Co., 2000.

REFERENCES

1. Voet and Voet, Biochemistry, 2nd Edition, John Wiley & Sons Inc., 1995.
2. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell. V.W., Harper's Biochemistry, Prentice Hall International.
3. Creighton. T.E., Proteins, Structure and Molecular Properties, 2nd Edition, W.H. Freeman and Co., 1993.
4. Salway, J.G., Metabolism at a Glance, 2nd Edition, Blackwell Science Ltd., 2000.

BT1303 BIOPROCESS PRINCIPLES 3 0 0 100

AIM

To develop skills of the students in the area of Bio process Technology with emphasis an Bioprocess principles. This is a pre-requisite for courses an Bioprocess technology offered in the subsequent semesters.

OBJECTIVES

At the end of the course, the students would have learnt about fermentation processes, Metabolic stoichiometry, Energetics, Kinetics of microbial growth etc. This will serve as an effective course to understand certain specialized electives in Bioprocess related fields.

UNIT I OVERVIEW OF FERMENTATION PROCESSES 6

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS 8

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

UNIT III STERILIZATION KINETICS 6

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS 12

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION 13

Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking-piret models, substrate and product inhibition on cell growth and product formation.

TOTAL : 45

TEXT BOOKS

1. Bailey and Ollis, “Biochemical Engineering Fundamentals”, McGraw-Hill (2nd Ed.), 1986.
2. Shule and Kargi, “Bioprocess Engineering”, Prentice Hall, 1992.

REFERENCES

1. Pauline Doran, “Bioprocess Engineering Calculation”, Blackwell Scientific Publications.
2. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, “Principles of Fermentation Technology”, Science & Technology Books.
3. Harvey W. Blanch, Douglas S. Clark, “Biochemical Engineering”, Marcel Dekker, Inc.

BT1304 MASS TRANSFER OPERATIONS 3 0 0 100

AIM

To develop skills of the students in the area of Mass Transfer operation. This will be a pre-requisite for courses offered in Engineering in the subsequent semesters.

OBJECTIVES

At the end of the course, the student would have learnt about Mass Transfer, Gas-Liquid, Vapour – liquid & solid – third operations. This will be beneficial to for the study of specialized electives and project work.

UNIT I DIFFUSION AND MASS TRANSFER 9

Molecular diffusion in fluids and solids; Inter phase Mass Transfer; Mass Transfer coefficients; Analogies in Transport Phenomenon.

UNIT II GAS LIQUID OPERATIONS 9

Principles of gas absorption; Single and Multi component absorption; Absorption with Chemical Reaction; Design principles of absorbers; Industrial absorbers; HTU, NTU concepts.

UNIT III VAPOUR LIQUID OPERATIONS 9

V-L Equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCABE-THIELE & PONCHON-SAVARIT Principles; Industrial distillation equipments, HETP, HTU and NTU concepts.

UNIT IV EXTRACTION OPERATIONS 9

L-L equilibria, Staged and continuous extraction, Solid-liquid equilibria, Leaching Principles.

UNIT V SOLID FLUID OPERATIONS 9

Adsorption equilibria – Batch and fixed bed adsorption; Drying-Mechanism-Drying curves-Time of Drying; Batch and continuous dryers.

TOTAL : 45

TEXT BOOKS

1. Treybal R.E. Mass Transfer Operations.3rd edition. McGraw-Hill, 1981.
2. Geankoplis C.J. Transport Processes and Unit Operations. 3rd edition, Prentice Hall of India, 2002.

REFERENCE

1. Coulson and Richardson's Chemical Engineering. Vol. I & II, Asian Books Pvt. Ltd, 1998.

BT1305 GENETIC ENGINEERING 2 1 0 100

AIM

To develop skills of the students in the area of genetic Engineering. This will be a pre-requisite for electives like genomics & proteomics, Immuno technology offered in the subsequent semesters.

OBJECTIVES

At the end of the course, the student would learnt about various aspects of genetic engineering and its application This will be very useful for the student to undertake research /project work in Modern Biology.

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 4

Role of genes within cells, genetic elements that control gene expression, restriction and modifying enzymes, safety guidelines of recombinant DNA research.

UNIT II CREATION OF RECOMBINANT MOLECULES 10

Restriction mapping, design of linkers and adaptors. Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors. Insect, Yeast and Mammalian vectors.

UNIT III CONSTRUCTION OF LIBRARIES 15

Construction of cDNA and genomic libraries. Screening of libraries with DNA probes and with antisera.

UNIT IV POLYMERASE CHAIN REACTION 10

Inverse PCR, Nested PCR, Taqman assay, Molecular beacons, RACE PCR, RAPD, site directed mutagenesis, methods of nucleic acid sequencing- Sangers method, (Kunkel's Method).

UNIT V APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY 6

Cloning in plants, Ti plasmid, and transgenic and knockout animals.

TOTAL : 45

TEXT BOOK

1. Old RW, Primrose SB, “Principles of Gene Manipulation, An Introduction To Genetic Engineering”, Blackwell Science Publications, 1993.
2. Ansubel FM, Brent R, Kingston RE, Moore DD, “Current Protocols In Molecular Biology”, Greene Publishing Associates, NY, 1988.

REFERENCES

1. Berger Sl, Kimmer AR, “Methods In Enzymology”, Vol. 152, Academic Press, 1987.

GE1302 COMMUNICATION SKILLS AND TECHNICAL SEMINAR 0 0 2

(Common to all branches)

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. Three periods per week are to be allotted and 15 students are expected to present the seminar, A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

This will enable them to gain confidence in facing the placement interviews.

BT1306 BIOPROCESS LAB 0 0 4 100

AIM

To provide hands on training by design of simple experiments to learn Bioprocess technology. This will be a pre-requisite to do project work in Bio process related areas.

OBJECTIVES

At the end of the course, the student would have learnt to perform experiments in the area of Bioprocess technology and how to apply on an Industrial scale. This knowledge will help him for certain elective course.

1. Growth of bacteria – estimation of biomass, calculation of specific growth rate, yield coefficient
2. Growth of yeast – estimation of biomass, calculation of specific growth rate, yield coefficient
3. Medium optimization – plackett burman design
4. Medium optimization – response surface methodology
5. Enzyme kinetics – Michelis Menton parameters
6. Enzyme activity – effect of temperature and ph
7. Enzyme inhibition kinetics
8. Enzyme immobilization – gel entrapment
9. Enzyme immobilization – cross linking
10. Preparation of bioreactor, utilities for bioreactor operation

BT1307 GENETIC ENGINEERING LAB 0 0 4 100

AIM

To provide hands on training in the Genetic Engineering by the designing simple experiments. This is a pre-requisite for Down-stream processing has offered in later semester.

OBJECTIVES

At the end of the course, the student would have learnt about the cloning of genes, how to express them for protein production & subsequent purification of protein. This will be needed for any project work in modern biology.

1. Preparation of plasmid DNA
2. Elution of DNA from agarose gels
3. Ligation of DNA into expression vectors
4. Transformation
5. Optimisation of inducer concentration for recombinant protein expression
6. Optimisation of time of inducer for recombinant protein expression
7. SDS-PAGE
8. Western blotting
9. Hybridisation with anti-sera
10. PCR.

BT1351 BIOINFORMATICS 3 0 0 100

AIM

This course aims to develop the skills of the students in Bioinformatics. This is a pre-requisite for certain elective courses offered in the subsequent semesters & for project work.

OBJECTIVES

At the end of this course, the students would have learnt about tools used in Bio informatics & how to use them. This will facilitate the students to undertake projects in the modern biology.

UNIT I INTRODUCTION 9

Basic UNIX commands – telnet – ftp – protocols – hardware – topology -search engines – search algorithms.

UNIT II DATABASES 9

Data management – data life cycle – database technology – interfaces and implementation – biological databases and their uses

UNIT III PATTERN MATCHING & MACHINE LEANING 9

Pairwise sequence alignment – local vs. global alignment – multiple sequence alignment – dot matrix analysis – substitution matrices – dynamic programming – bayesian methods – tools – BLAST – FASTA- machine learning – neural networks – statistical methods – Hidden Markov models.

UNIT IV PHYLOGENY 9

Introduction; mutations; irrelevant mutations; controls; mutations as a measure of time; distances; reconstruction; distances between species; estimating time intervals from distances.

UNIT V ADVANCED TOPICS IN BIOINFORMATICS 9

Biomolecular and cellular computing – micro array analysis – systems biology.

TOTAL : 45

TEXT BOOKS

1. B. Bergeron, Bioinformatics Computing, PHI, 2002.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., Instant Notes In Bioinformatics, BIOS Scientific Publishers, 2000.

REFERENCE

1. C. Gibas & P. Jambeck, Developing Bioinformatics Skills, O'Reilly, 1999.

BT1352 CHEMICAL REACTION ENGINEERING 3 0 0 100

AIM

This course aims to develop the skills of the students in the area of chemical reaction engineering. This is a pre-requisite for courses offered in Bioprocess Technology a few electives.

OBJECTIVES

At the end of the course, the student would have learnt chemical kinetics, various types of reactors, and how they function. This will help the student to take up PG courses in Bioprocess, Biochemical Engg., and also the project work.

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 8

Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

UNIT II IDEAL REACTORS 10

Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.

UNIT III IDEAL FLOW AND NON IDEAL FLOW 10

RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS 9

Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

UNIT V FIXED BED AND FLUID BED REACTORS 8

G/l reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

TOTAL : 45

TEXT BOOKS

1. Levenspiel O. “Chemical Reaction Engineering”, 3rd Edition. John Wiley.1999.
2. Fogler H.S. “Elements Of Chemical Reaction Engineering”, Prentice Hall India.2002

REFERENCE

1. Missen R.W., Mims C.A., Saville B.A. “Introduction To Chemical Reaction Engineering And Kinetics”, John Wiley.1999.

BT1353 BIOPROCESS ENGINEERING 3 0 0 100

AIM

This course aims to develop the skills of the students in the area of Bioprocess Engineering. This will be a pre-requisite for a few elective courses and for project in Bioprocess Technology.

OBJECTIVES

At the end of the course, the student would have learnt about stirred Tank reactors and configuration of various reaches, and how to model and similar a Bio process. This will help the student to undertake project in the area of Bio process Technology.

UNIT I ANALYSIS OF STR 8

Stirred tank reactor - non-ideality, RTD and stability analysis, tanks in series and dispersion models – application to design of continuous sterilizer.

UNIT II ANALYSIS OF OTHER CONFIGURATIONS 8

Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors – non-ideality, RTD and stability analysis.

UNIT III BIOREACTOR SCALE – UP 9

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors - microbial oxygen demands; methods for the determination of mass transfer coefficients; mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed.

UNIT IV MODELLING AND SIMULATION OF BIOPROCESSES 12

Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.

UNIT V BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS 8

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors.

TOTAL : 45

TEXT BOOKS

1. Anton Moser, “Bioprocess Technology”, Kinetics and Reactors”, Springer Verlag.
2. James E. Bailey & David F. Ollis, “Biochemical Engineering Fundamentals”, McGraw-Hill.

REFERENCES

1. James M. Lee, “Biochemical Engineering”, PHI, USA.
2. Atkinson, “Handbook of Bioreactors”,
3. Harvey W. Blanch, Douglas S. Clark, “Biochemical Engineering”, Marcel Decker Inc.

BT1354 PROTEIN ENGINEERING 3 0 0 100

AIM

This course aims to develop the skills of the students in the area of Protein Engineering. This is a pre-requisite for a few elective courses offered in the subsequent semesters.

OBJECTIVES

At the end of the course, the student would have learnt structure and function of proteins of particular importance, the student will know the production of recombinant insulin & in general how to engineer protein to be used as therapeutics.

UNIT I BONDS AND ENERGIES IN PROTEIN MAKEUP 5

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

UNIT II AMINO ACIDS AND THEIR CHARACTERISTICS 5

Amino acids (the students should be thorough with three and single letter codes) and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

UNIT III PROTEIN ARCHITECTURE 12

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass-spec. High-throughput protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine
Super-secondary structure: Alpha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites
Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures, Quaternary structure: Modular nature, formation of complexes.

UNIT IV STRUCTURE-FUNCTION RELATIONSHIP 15

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Trans-membrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

UNIT V PROTEIN ENGINEERING 8

Advantages and purpose, overview of methods, underlying principles with specific examples: thermal stability T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, *de novo* protein design.

TOTAL : 45

TEXT BOOKS

1. Voet D. and Voet G., “Biochemistry”, Third Edn. John Wiley and Sons, 2001
2. Branden C. and Tooze J., “Introduction to Protein Structured, Second Edition”, Garland Publishing, NY, USA, 1999

REFERENCES

1. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993
2. Moody P.C.E. and Wilkinson A.J. “Protein Engineering”, IRL Press, Oxford, UK, 1990.

GE1351 PRESENTATION SKILLS AND TECHNICAL SEMINAR 0 0 2 -
(Common to all branches)

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. Three periods per week are to be allotted and 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.
This will enable them to gain confidence in facing the placement interviews.

BT1355 BIOPROCESS LAB II 0 0 6 100

AIM

This course aims to provide hands a training in the laboratory of Bio process Technology by performing simple experiments.

OBJECTIVES

At the end of the course, the student would have learnt about Bioreactors & how to use them for practical applications. This will be beneficial to students to undertake project work in this area.
1. Thermal death kinetics

2. Batch sterilization design
3. Batch cultivation, estimation of kla – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing
4. Fed batch cultivation, exhaust gas analysis – carbon balancing, gas balancing
5. Total cell retention cultivation, exhaust gas analysis – carbon balancing, gas balancing
6. Estimation of kla – sulphite oxidation method
7. Estimation of kla – power correlation method
8. Residence time distribution
9. Estimation of overall heat transfer coefficient
10. Continuous cultivation – x-d diagram, pulse and shift method, evaluation of kinetic parameters, exhaust gas analysis – carbon balancing, gas balancing.

MG1351 PRINCIPLES OF MANAGEMENT 3 0 0 100

(Common to all Branches)

OBJECTIVE

Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge on international aspect of management.

UNIT I HISTORICAL DEVELOPMENT 9

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

UNIT II PLANNING 9

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

UNIT III ORGANISING 9

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentization by different strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV DIRECTING 9

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING 9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL : 45

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich “Essentials of Management”, Tata McGraw-Hill, 1998.
2. Joseph L Massie “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCES

1. Tripathy PC And Reddy PN, " Principles of Management", Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, "Engineering Management", Addison Wesley, 2000.

BT1401 DOWNSTREAM PROCESSING 3 1 0 100

AIM

This course aims to develop the skills of the students in the area of Downstream processing. This is a pre-requisite for courses in Bioprocess Technology.

OBJECTIVES

At the end of the course, the student would have learnt about ,methods to obtain pure proteins, enzymes and in general about product development R & D. This will be handy for projects of Industries.

UNIT I DOWNSTREAM PROCESSING 8+3

Introduction to downstream processing principles characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilisation of bioproducts.

UNIT II PHYSICAL METHODS OF SEPERATION 6+3

Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III ISOLATION OF PRODUCTS 12+3

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV PRODUCT PURIFICATION 12+3

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS 7+3

Crystallization, drying and lyophilization in final product formulation.

TUTORIAL 15

TOTAL : 60

TEXT BOOKS

1. P.A. Belter, E.L. Cussler And Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pub. (1988).
2. R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open Learning Series, Butterworth-Heinemann (1992).

REFERENCES

1. J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.
2. R.K. Scopes – Protein Purification – Principles And Practice, Narosa Pub. (1994).

BT1402 IMMUNOLOGY 3 1 0 100

AIM

This course aims to develop the skills of the students in Immunotechnology, Proteomics and genomics etc.

OBJECTIVES

At the end of the course would have learnt about the mechanisms by which a human body interacts with a pathogenic microbe & how it eliminates it. Students, also familiarize themselves with the pathogenesis of diseases like AIDS, Cancer, TB etc.

UNIT I INTRODUCTION 6+2

Cells of immune system; innate and acquired immunity; primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

UNIT II CELLULAR RESPONSES 12+3

Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

UNIT III INFECTION AND IMMUNITY 16+5

Injury and inflammation; immune responses to infections: immunity to viruses, bacteria, fungi and parasites; cytokines; complement; immunosuppression, tolerance; allergy and hypersensitivity; AIDS and Immunodeficiencies; resistance and immunisation; Vaccines.

UNIT IVTRANSPLANTATION AND TUMOR IMMUNOLOGY 8+2

Transplantation: genetics of transplantation; laws of transplantation;; tumor immunology.

UNIT V AUTOIMMUNITY 3+1

Autoimmunity, Autoimmune disorders and diagnosis.

TUTORIAL 15

TOTAL : 60

TEXT BOOKS

1. Roitt I, Male, Brostoff. Immunology, Mosby Publ., 2002.
2. Kuby J, Immunology, WH Freeman & Co., 2000.

REFERENCE

1. Ashim K. Chakravarthy, Immunology, Tata McGraw-Hill, 1998.

BT1403 ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY 0 0 6 100
(Demonstrations & Seminar)

AIM

This course aims to develop skills of students by providing training an techniques used in modern biology. This will be a pre-requisite for any project work that the student undertakes.

OBJECTIVES

At the end of the course, the student would have the knowledge to perform Chromatography, ELISA, PCR, and how to run a Fermentor. This will help students in their PG studies.

1. Principles of Various types of centrifugation
2. Principles of Chromatography: TLC Paper & Silica, Column –Silica and Alumina, HPLC
3. Principles of Electrophoresis – 2D gel & Iso electric focusing.
4. Principles of Immunological techniques – ELISA, Cell identification using monoclonal antibodies & PCR FACS.
5. Principles of electro poration RFLP & DNA sequencing.
6. Running of a pilot fermentor.

TOTAL : 45

REFERENCE

1. Readings In Scientific American, W.H. Freeman, 1985-1993.

BT1404 DOWNSTREAM PROCESSING LAB 0 0 4 100

AIM

To provide hands on training in Down stream processing by through simple experimentation in the laboratory. This will be a pre-requisite for project work.

OBJECTIVES

At the end of the course, the student has gained the knowledge to perform various techniques used in Down Stream Processing and how to make a finished project.

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruption techniques – ultrasonication, French pressure cell
3. Cell disruption techniques – dyno mill – batch and continuous
4. Precipitation – ammonium sulphite precipitation
5. Ultra filtration separation
6. Aqueous two phase extraction of biologicals
7. High resolution purification – affinity chromatography
8. High resolution purification – ion exchange chromatography
9. Product polishing – gel filtration chromatography
10. Product polishing – spray drying, freeze drying

BT1405 IMMUNOLOGY LAB 0 0 4 100

AIM

The develop skills of students in Immunology by performing simple experiments in the laboratory.

OBJECTIVES

At the end of the course the student would have gained knowledge to perform techniques like blood grouping, ELISA, & identification of T-cell, Immuno fluorescence etc. This will be of help in facilitating the students for project work.

1. Handling of animals, immunization and raising antisera
2. Identification of cells in a blood smear
3. Identification of blood group
4. Immuno diffusion & immuno electrophoresis
5. Testing for typhoid antigens by Widal test
6. Enzyme Linked Immuno Sorbent Assay (ELISA)
7. Isolation of peripheral blood mononuclear cells
8. Isolation of monocytes from blood
9. Immuno fluorescence

10. Identification of t cells by T-cell rossetting using sheep RBC.

MG1401 TOTAL QUALITY MANAGEMENT 3 0 0 100

(Common to all branches)

OBJECTIVE

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

TEXT BOOK

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, 1999. (Indian reprint 2002).
2. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

REFERENCES

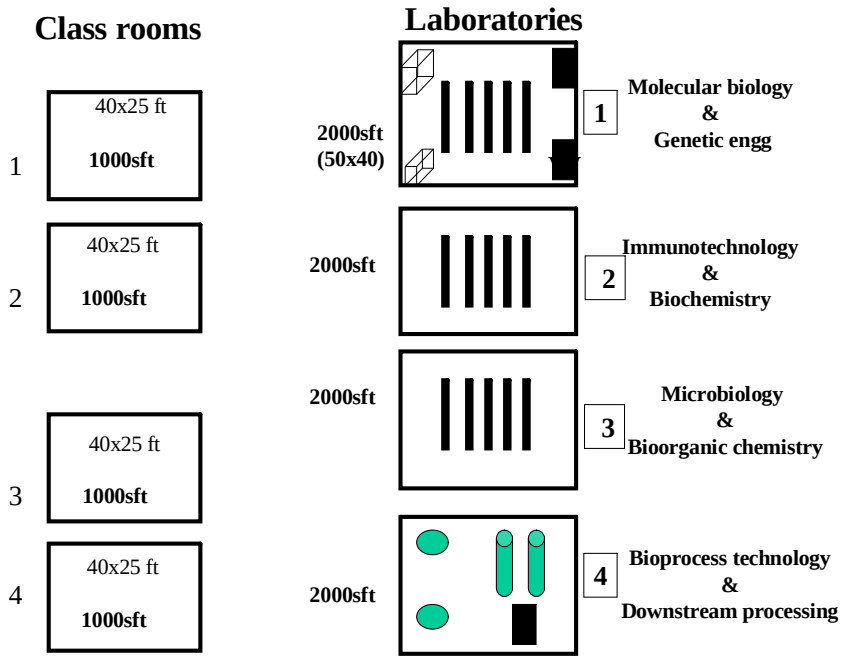
1. Feigenbaum.A.V. “Total Quality Management”, McGraw-Hill, 1991.
2. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996.
4. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

B.Tech. Biotechnology
Laboratory Equipment Required
(for the batch consisting of 30 students)

Sl.No.	Description	Quantity
Biochemistry Practical		
1.	pH meter	2
2.	Colorimeter	3
3.	Water bath (dry bath 40^{o}C – 120^{o}C preferred; but expensive)	3
4.	Balance (500 g – 0.1g)	1
5.	Balance (0.1mg)	1
6.	Table top Centrifuge	1
7.	Microfuge	2
8.	Micropipettes 20 μl – 200μl; 1 μl -20 μl	6
9.	Oven	1
10.	UV – vis Spectrometer	1
11.	Vortexer	4
12.	Magnetic Stirrer	2
13.	Fume hood	1
14.	Bunsen Burner	4
15.	Micro plate Reader (vis-range) (300 – 700 nm)	1
Immunology Practical		
16.	Micro plate Reader	1
17.	Micro plate Washer	1
18.	Tabletop Refrigerated centrifuge (Swinging bucket-rotor)	1
19.	Tabletop Refrigerated Centrifuge (fixed angle)	1
20.	Electrophoresis Units	1
21.	Transfer apparatus	1
22.	Light microscope	5
23.	Phase contrast microscope	1
24.	Fluorescent microscope	1
25.	Hemo cytometer	1
26.	CO_2 Incubator	1
27.	Laminar flow hood (other than that used for bacterial work)	2
28.	Cylinders & Bunsen burners	2
29.	Autoclave	1
Downstream Processing Lab.		
30.	Cell breaking device (Sonicator OR French Press OR Dynomill Homogenizer)	1
31.	Cell harvesting (Micro filtration module)	1
32.	Cell harvesting (Centrifuge tubular OR Disc & bowl OR lab Centrifuge	1
33.	Ultra filtration module	1
34.	Chromatography system	1
35.	PD 10 columns	1
36.	UV spectrophotometer	1
BIOPROCESS LAB – 1		
37.	Shaker	2
38.	Laminar Flow Chamber	2
39.	Water bath	2
40.	Spectrophotometer	1
41.	pH meter	1
42.	Weighing balance	1

43.	Vortex mixer	2
44.	Peristaltic pump	2
45.	Glass columns for packed bed studies	2
46.	Micro centrifuge	1
BIOPROCESS LAB – 2		
47.	Bioreactor (3 batch & 1 continuous) (One reactor should be in-situ sterilizable)	4
48.	Gas analyzer	1
49.	Refrigerated water bath	1
50.	Air compressor	1
51.	Peristaltic pump	6
Analytical Techniques in Biotechnology		
52.	Micro centrifuge	1
53.	Table top	1
54.	Ultra top	1
55.	Chromatographic columns	1
56.	2D gel apparatus	1
57.	ELISA reader	1
58.	PCR Machine	1
59.	Electroporator	1
60.	300 L fermentor	1
61.	HPLC	1
Molecular Biology:		
62.	Weighing balance Analytical	1
63.	Microcentrifuge (Non refrigerated)	2
64.	Refrigerated microfuge	2
65.	Micro oven	1
66.	DNA electrophoresis tank(complete set)	3
67.	Rock and Roll	2
Genetic Engineering:		
68.	Gel documentation system	1
69	UV-trans illuminator	1
70.	Laminar Hood	1
71.	Spectrophotometer	1
72.	Water bath shaker	1
73.	Refrigerator	1
74.	Incubator	1
75.	SDS-PAGE electrophoresis	4 set
76.	Sonicator	1
77.	Dot blot apparatus	2
78.	Western blot apparatus	2
79.	-20°C Deep Freezer	1
80.	PCR machine	1
81.	ELISA Reader	1
82.	Ice-flake machine	1
83.	High speed centrifuge	1
84.	Vortex machine	4

ORGANIZATION OF CLASS ROOMS AND LABORATORIES



Total area : 4000 + 8000 +1000 =13,000sft

MICROBIOLOGY LAB

Equipment	Cost (lakhsof Rs.)
laminar flow hood	1.0
Refrigerator	0.2
microscope 2	3.0
Water bath shakers 3	3.0
incubators 2	1.0
table top centrifuge 2	0.5
vortex machine	0.2
Spectrophotometer	2.0
pH meter 2	0.2
TOTAL	11.1

BIOPROCESS LABORATORY

I Fermentation	Cost (lakhs of Rs.)
baby reactors 2	15.0
peristaltic pumps 5	2.5
Chiller	1.5
Compressor	1.0
Computers with software	2.0
Load cell	1.0
High Pressure Liquid Chromatography	15.0
	38 .0
Optional Gas analyzer	10.0
Online glucose analyzer	3.0
Gas chromatography	3.0
	16.0
TOTAL	**54.0**

DOWN STREAM PROCESSING

Sonicator	**3.0**
microfiltration/ultrafiltration kit	5.0
Fast Protein	12.0
Liquid Chromatography. freeze drier (lyophiliser)	10.0
	30.0
Optional	
french press	5.0
spray drier	10.0
	15.0
TOTAL	**45.0**

CHEMICAL ENGINEERING LABORATORY

Equipment	Cost (lakhs of Rs.)
Flow meters	0.5
Orifice-meter	0.5
Venturi-meter	0.5
packed bed reactor	1.0
fluidised bed reactor	1.0
jaw crusher	1.0
sieving equipment	0.2
leaf filter	2.0
filter press	2.0
rotary drum filter	2.0
double pipe heat exchanger	1.0
shell and tube heat exchanger	1.0
film type evaporator	2.0
TOTAL	**14.7**

Cell biology / Molecular Biology / Genetic Engineering / Immuno Technology Lab

Equipment	Cost (lakhs)
DNA electrophoresis apparatus, Tank, gel plates.	2.0
UV Trans illuminator	2.0
Gel documentation system	6.0
SDS PAGE apparatus	2.0
Western blot apparatus	2.5
Dot Blot apparatus	1.0
ELISA reader	2.5
Sonicator	1.5
Ultracentrifuge (small)	5.0
PCR machine single plate/gradient	3.0
Weighing balances	2.0
Micro oven 2	0.4
Centrifuges (Ordinary / Refrigerated)	10.0
Laminar flow hood	1.0
Rockers 2	0.2
Scintillation counter	3.0
Autoclave	0.5
Deep freeze –20 °C	2.0
Distillation unit (double distilled water)	0.1
TOTAL	**46.7**

BT1001 ENVIRONMENTAL BIOTECHNOLOGY 3 0 0 100

AIM

To develop the skills of the students in the area of Environmental biotechnology and its prerequisite for PG studies in Biotechnology.

OBJECTIVES

At the end of the course, the student would have learnt about microorganisms in the environment and their characteristics, control of pollution and treatment of Industrial wastes. This will facilitate the students to take up project work in this area of biotechnology.

UNIT I FUNDAMENTALS OF MICRO-ORGANISMS 9
Microbial flora of soil, growth, ecological adaptations, interactions among soil microorganisms, biogeochemical role of soil microorganisms.

UNIT II DEGRADATION OF XENOBIOTIC COMPOUNDS 9
Simple aromatics, chlorinated polyaromatic petroleum products, pesticides and surfactants.

UNIT III INDUSTRIAL WASTE WATER MANAGEMENT 9
Waste water characteristics, biological waste water treatment, unit operations, design and modeling of activated – sludge process, mathematics modeling of anaerobics – digested dynamics.

UNIT IV TREATMENT O INDUSTRIAL WASTES 9
Dairy, pulp, dye, leather and pharamaceuticals, solid waste management.

UNIT V MOLECULAR BIOLOGY 9
Latest elements, developments pertaining to environmental biotechnology.

TOTAL : 45

TEXT BOOKS

1. Stanir R.Y., Ingraham.J.L., Wheelis.M.L., Painter R.R., general Microbiology, McMillan Publications, 1989.
2. Foster C.F., john Ware D.A., environmental Biotechnology, Ellis Honwood Ltd., 1987.

REFERENCE

1. Karnely D., Chakrbarty.K., Omen G.S., biotechnology and Biodegradation, Advances in Applied Biotechnology Series, Vol, Gulf Publications Co., London, 1989.

BT1002 PLANT BIOTECHNOLOGY 3 0 0 100

AIM

To develop the skills of the students in the area of Plant Biotechnology.

OBJECTIVES

At the end of the course the student would have learnt about the applications of Genetic Engineering in Plant and how to develop Transgenic plants. This will facilitate the student to take up project work in this area.

UNIT I ORGANIZATION OF GENETIC MATERIAL 9
Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation.

UNIT II CHLOROPLAST & MITOCHONDRIA 9
Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins.

UNIT III NITROGEN FIXATION 9
Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV AGROBACTERIUM & VIRAL VECTORS 9
Pathogenesis, crown gall disease, genes involved in the pathogenesis, Ti plasmid – t-DNA, importance in genetic engineering. Viral Vectors: Gemini virus, cauliflower mosaic virus, viral vectors and its benefits.

UNIT V APPLICATION OF PLANT BIOTECHNOLOGY 9

Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, theraputic products.

TOTAL : 45

TEXT BOOKS

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, Narosa Publications. 1995.
2. Singh BD. Text Book of Biotechnology, Kalyani Publishers. 1998

REFERENCES

1. Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.
2. Ignacimuthu .S, Applied Plant Biotechnology, Tata McGraw-Hill. 1996.

CH1355 PROCESS INSTRUMENTATION DYNAMICS AND CONTROL 3 0 0 100

AIM

To introduce control equipments used to control the production process of a chemical factory and to introduce the control mechanism thro' automation and computers.

OBJECTIVES

Gains knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant. He will be familiar with the control mechanism before attempting to tackle process control problems.

UNIT I 9

Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application .Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.

UNIT II 9

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulator problems, Transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.

UNIT III 9

Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram; Tuning of controller settings.

UNIT IV 9

Controller mechanism ,introduction to advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.

UNIT V 9

Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.

TOTAL : 45

TEXT BOOKS

1. Coughnowr and Koppel, “Process Systems Analysis and Control”, McGraw-Hill, New York, 1986.
2. George Stephanopolous, “Chemical Process Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 1990.
3. Patranabis.D, Principles of Process control, II edition, Tata McGraw-Hill Publishing Co. Ltd., 1981.
4. Peter Harriott, Processcontrol, Tata McGraw-Hill Publishing Co., Reprint 2004.

REFERENCES

1. Thomas, E.Marlin, Process Control, 2nd Edn, McGraw-Hills International Edn. 2000.
2. George Stephanopoulos, Chemical Process Control, Prentice Hall of India 2003.
3. Norman H.CEAGLSKE, Automatic process control for chemical engineers, John Wiley & Sons, Japan.
4. Emenule, S.Savas, “Computer Control of Industrial Processes”, McGraw-Hill, London, 1965.
5. Eckman, D.P., “Industrial Instrumentation”, Wiley, 1978.

BT1004 BIOCONJUGATE TECHNOLOGY 3 0 0 100

AIM

To develop the skills of Student in the area of Bio conjugate technology and its industrial applications.

OBJECTIVES

At the end of the course, the student would have learnt about enzymes, nucleic acids and how to modify them for target specificity. Student also gets familiarized with the industrial applications of this technology.

UNIT I FUNCTIONAL TARGETS 9

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

UNIT II CHEMISTRY OF ACIVE GROUPS 9

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

UNIT III BIOCONJUGATE REAGENTS 9

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

UNIT IV ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION 9

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

UNIT V BIOCONJUGATE APLICATIONS 9

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives- Colloidal – gold-labeled proteins – modification with synthetic polymers.

TOTAL : 45

TEXT BOOK

1. Bioconjugate Techniques, G.T. Hermanson, Academic Press, 1999.

BT1005 ANIMAL BIOTECHNOLOGY 3 0 0 100

AIM

To develop the skills of the students in the area of animal biotechnology and its applications.

OBJECTIVES

At the end of the course, the student would have learnt about animal cell culture, molecular diagnostic of animal diseases and Transgenic animal production. This will facilitate the student to undertake project work in this area.

UNIT I ANIMAL CELL CULTURE 12

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures- suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.

UNIT II ANIMAL DISEASES AND THEIR DIAGNOSIS 10

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, *in-situ* hybridization; northern and southern blotting; RFLP.

UNIT III THERAPY OF ANIMAL DISEASES 12

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.

UNIT IV MICROMANIPULATION OF EMBRYO'S 6

What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

UNIT V TRANSGENIC ANIMALS 5

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

TOTAL: 45

TEXT BOOKS

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. Text Book Of Animal Biotechnology. Akshara Printers, 1997.

REFERENCE

1. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press, 2000

BT1006 PRINCIPLES OF FOOD PROCESSING 3 0 0 100

AIM

To develop the skills of the students in the area of Food Process Technology and its applications.

OBJECTIVES

At the end of the course, the student would have gained knowledge in various aspects of Food processing & its importance for industrial applications. This will facilitate the student to take up higher studies in the area.

UNIT I FOOD AND ENERGY 9

Constituents of food – carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.

UNIT II FOOD ADDITIVES 9

Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants – natural and artificial; food flavours; enzymes as food processing aids.

UNIT III MICROORGANISMS ASSOCIATED WITH FOOD 9

Bacteria, yeasts and molds – sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein.

UNIT IV FOOD BORNE DISEASES 9

Classification – food infections – bacterial and other types; food intoxications and poisonings – bacterial and non-bacterial; food spoilage – factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

UNIT V FOOD PRESERVATION 9

Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; frozen storage-freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage; irradiation preservation of foods.

TOTAL : 45

TEXT BOOKS

1. T.P. Coultate – Food – The Chemistry Of Its Components, 2nd Edn. Royal Society, London, 1992.
2. B. Sivasanker – Food Processing And Preservation, Prentice-Hall Of India Pvt. Ltd. New Delhi 2002.

REFERENCES

1. W.C. Frazier And D.C. Westhoff – Food Microbiology, 4th Ed., McGraw-Hill Book Co., New York 1988.
2. J.M. Jay – Modern Food Microbiology, CBS Pub. New Delhi, 1987.

BT1007 PROCESS EQUIPMENTS AND PLANT DESIGN 3 0 0 100

AIM

To develop the skills of the students in the are of process equipment and Design. This is a pre-requisite for higher PG studies in Biotechnology.

OBJECTIVES

At the end of the course, the student would have learnt about various types of process equipment, principles involved in their function, and its industrial applications.

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS 12

Single and multi process exchangers, double pipe, U tube heat exchangers, combustion details supporting structure. Single and vertical tube evaporation, Single and multi effect evaporators, forced circulation evaporators.

UNIT II STORAGE VESSEL FOR VOLATILE AND NON VOLATILE FLUIDS, PRESSURE VESSEL STRUCTURE 6

Design of the following equipments as per ASME, ISI codes, drawing according to scale; monoblock and multiplayer vessels, combustion details and supporting structure.

UNIT III EXTRACTOR, DISTILLATION AND ABSORPTION TOWER 10

Construction details and assembly drawing; Plate and Packed Extraction Towers; Plate and Packed absorption Towers; Plate and Packed Distillation Towers.

UNIT IV PUMPS, MECHANICAL SEALS, VALVES AND SWITCHES 8

Various types of pumps, Principle of working, construction, usages, advantages and disadvantages; Various types of seals, effectiveness, usages; Pneumatic Seals; Gate, Globe and Butterfly Valves, their material of construction; Pneumatically Controlled Valves.

UNIT V PIPING, PLANT LAY OUT AND DESIGN 9

Various types of Piping, material of construction, their usage; Pipe lay out; Modern Plant Design and case Studies.

TOTAL : 45

TEXT BOOKS

1. Brownbell I.E., Young E.H., Chemical Plant Design, 1985
2. Kern D.Q. “Heat Transfer”, McGraw-Hill, 1985.

REFERENCE

1. McCabe W.L., Smith J.C. “Unit Operations in Chemical Engineering”, McGraw-Hill, 1976.

BT1008 BIOPHYSICS 3 0 0 100

AIM

The develop the skills of the students in the area of Biophysics and is a prerequisite for PG studies in biotechnology.

OBJECTIVES

At the end of the course, the student would have learnt about Molecular structure of biological systems, Cell permeability and conformation of proteins and Nucleic acids. This course facilitates the students to take specialization in computation Biology.

UNIT I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS 9

Intramolecular bonds – covalent – ionic and hydrogen bonds – biological structures -general features – water structure – hydration – interficial phenomena and membranes – self assembly and molecular strucutre of membranes.

UNIT II CONFORMATION OF NUCLEIC ACIDS 9

Primary strucutre – the bases – sugars and the phosphodiester bonds- double helical structure – the a, b and z forms – properties of circular DNA– topolgy – polymorphism and flexibility of DNA – strucutre of ribonucleic acids – hydration of nucleic acids.

UNIT III CONFORMATION OF PROTEINS 9

Conformation of the peptide bond – secondary structures – ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.

UNIT IV CELLULAR PERMEABILITY AND ION – TRANSPORT 9

Ionic conductivity – transport across ion channels – mechanism - ion pumps- proton transfer – nerve conduction – techniques of studying ion transport and models.

UNIT V ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS 9

Concepts in thermodynamics – force and motion – entropy and stability – analyses of fluxes – diffusion potential – basic properties of fluids and biomaterials – laminar and turbulent flows.

TOTAL : 45

TEXT BOOKS

1. Biophysics; R. Glaser, Springer Verlag, 2000.
2. Biophysics: Molecules In Motion; R. Duane. Academic Press, 1999.

BT1009 CANCER BIOLOGY 3 0 0 100

AIM

To develop skills of the students in the area of Cancer Biology.

OBJECTIVES

At the end of the course, the student would have learnt about pathogenesis of cancer, identifications of cancer through tools developed by biotechnology research & molecules synthesized for cancer therapy. This will be very beneficial for the student to take up projects in Cancer Biology.

UNIT I FUNDAMENTALS OF CANCER BIOLOGY 9

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II PRINCIPLES OF CARCINOGENESIS 12

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 9

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

UNIT IV PRINCIPLES OF CANCER METASTASIS 9

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V NEW MOLECULES FOR CANCER THERAPY 6

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

TOTAL : 45

TEXT BOOKS

1. Maly B.W.J, "Virology A Practical Approach", IRLl Press, Oxford, 1987.
2. Dunmock N.J And Primrose S.B., "Introduction to Modern Virology", Blackwell Scientific Publications, Oxford, 1988.

REFERENCE

1. "An Introduction Top Cellular And Molecular Biology of Cancer", j Oxford Medical Publications, 1991.

BT1010 BIOPHARMACEUTICAL TECHNOLOGY 3 0 0 100

AIM

The develop skills of the students in the area of Biopharmaceutical Technology. This course is effective for PG studies in Biotechnology.

OBJECTIVES

At the end of the course, the students would have learnt about Drug manufacture, Drug action and Drug metabolism and production of Biopharmaceuticals. This will facilitate the students to take up projects work in this area of Biotechnology.

UNIT I INTRODUCTION 7

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.

UNIT II DRUG ACTION, METABOLISM AND PHARMACOKINETICS 9

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; pharmaco kinetics.

UNIT III MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS 7

Types of reaction process and special requirements for bulk drug manufacture.

UNIT IV PRINCIPLES OF DRUG MANUFACTURE 15

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; gmp.

UNIT V BIOPHARMACEUTICALS 7

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

TOTAL : 45

TEXT BOOKS

1. Gareth Thomas. Medicinal Chemistry. An introduction. John Wiley. 2000.
2. Katzung B.G. Basic and Clinical Pharmacology, Prentice Hall of Intl. 1995.

BT1011 MMUNOTECHNOLOGY 3 0 0 100

AIM

To develop the skills of the students in the area of Immunotechnology pre-requisite for PG studies in biotechnology & related fields.

OBJECTIVES

At the end of the course, the student would have learnt various techniques like developing diagnostic tests, characterization of lymphocytes, purification of antigens, Antibody Engineering etc. This knowledge will beneficial for Industrial applications.

UNIT I ANTIGENS 3

Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action.

UNIT II ANTIBODIES & IMMUNODIAGNOSIS 9

Monoclonal and polyclonal antibodies – their production and characterization, western blot analysis, immuno electrophoresis, SDS-PAGE, purification and synthesis of antigens, ELISA-principle and applications, radio immuno assay (RIA) principles and applications, non isotopic methods of detection of antigens-enhanced chem. iluminescence assay.

UNIT III ASSEMENT O CELL MEDIATED IMMUNITY 12

Identification o lymphocytes and their subsets in blood. T cell activation parameters, estimation of cytokines, macrophages activation, macrophage activation, macrophage microbicidal assays, in-vitro experimentation-application of the above technology to understand the pathogenesis of infectious diseases.

UNIT IV IMMUNOPATHOLOGY 6

Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterization of cell types from inflammatory sites and infected tissues, functional studies on isolated cels, immuno cytochemistry – immuno fluoresecence, immuno enzymatic and immuno ferrtin techniques, immuno electron microscopy.

UNIT V MOLECULAR IMMUNOLOGY 9

Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of antidiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immuno therapy with genetically engineered antibodies.

UNIT VI CURRENT TOPICS IN IMMUNOLOGY 6

Trends in Immunology of infectious diseases and tumours, topics as identified from time to time.

TOTAL : 45

TEXT BOOKS

1. Talwar G.P., and Gupta S.K., “A hand book of practical and clinical immunology”, Vol. 1 & 2, CBS Publications, 1992.
2. Weir D.M., Practical Immunology, Blackwell Scientific Publications, Oxford, 1990.

REFERENCE

1. Austin J.M. and Wood K.J., Principle of cellular and molecular immunology, Oxford university press, Oxford, 1993.

BT1012 BIOLOGICAL SPECTROSCOPY 3 0 0 100

AIM

To develop the skills of the students in the area of Biological spectroscopy. Prerequisite for PG studies in Biotechnology.

OBJECTIVES

At the end of the course, the student would have learnt about various kinds spectroscopic techniques to study biological system. This course is very effective in the area of Drug Design.

UNIT I OPTICAL ROTATORY DISPERSION 5

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II NUCLEAR MAGNETIC RESONANCE 10

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear overhauser effect – multidimensional nmr spectroscopy – detemination of macromolecular structure by NMR – magnetic resonance imaging.

UNIT III MASS SPECTROMETRY 10

Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass sepctrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV X-RAY DIFFRACTION 10

Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – bragg reflection – unit cell – phase problem – anomalous diffraction – detemination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS 10

Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TOTAL : 45

TEXT BOOKS

1. Campbell I.D and Dwek R.A., “Biological Spectroscopy”, Benjamin Cummins and Company, 1986.

2. Atkins P.W., “Physical Chemistry”, Oxford IV Edition, 1990.

BT1013 MOLECULAR MODELING & DRUG DESIGN 3 0 0 100

AIM

To develop skills of students in the area of Molecular modeling. Prerequisite for courses on Drug Design.

OBJECTIVES

At the end of the course the student would have learnt Classical & Statistical mechanics, and Quantum mechanics and its applications.

UNIT I INTRODUCTION TO CLASSICAL MECHANICS 9

Newtons laws of motion – time intervals- algorithms

UNIT II INTRODUCTION TO STATISTICAL MECHANICS 9

Boltzman's Equation – Ensembles – Distribution law for non interacting molecules – Statistical mechanics of fluids.

UNIT III QUANTUM MECHANICS 9

Photoelectric effect – De Broglies hypothesis – Uncertainty principle – Schrodingers time independent equation – particle in a one -dimensional box.

UNIT IV GROMOS, GROMACS, AMBER & DOCK 9

Energy minization, application of Fourier transformer – force fields – principal components analysis – RMSD calculation – applications – dynamics of a molecule – concepts of parallezing work.

UNIT V GAUSSIAN 98 9

Methods – Basic sets – Model chemiststrix – inputs – outputs – uses.

TOTAL : 45

TEXT BOOKS

1. Statistical Mechanics; D. McQuarrie, Narosa, 1999.
2. Quantum Mechanics; D. McQuarrie, Narosa, 1999.

REFERENCE

1. GROMOS Handbook.

BT1014 MOLECULAR PATHOGENESIS 3 0 0 100

AIM

To develop the skills of the students in the area of Molecular Pathogenesis.

OBJECTIVES

At the end of the course, the students would have learnt about Host Parasite interactions, Host defense mechanisms and molecular mechanisms involved in Pathogenesis of diseases caused by E.Coli and Vibrio. Cholerae.

UNIT I OVERVIEW 5

Historical perspective - discovery of microscope, Louis Pasteur's contributions, Robert Koch's postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 8

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) 16

Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival *E.coli* pathogens: Enterotoxigenic *E.coli* (ETEC), labile & stable toxins, Entero- pathogenic *E.coli* (EPEC), type III secretion, cytoskeletal changes, intimate attachment; Enterohaemerrohogic *E.coli* (EHEC), mechanism of bloody diarrhoea and Hemolytic Uremic Syndrome, Enteroaggregative *E.coli* (EAEC). Shigella: Entry, macrophage apoptosis, induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory response, tissue damage Plasmodium: Life cycle, erythrocyte stages, transport mechanism and processes to support the rapidly growing schizont, parasitiparous vacuoles, and knob protein transport, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 8

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS 8

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TOTAL : 45

TEXT BOOKS

1. Iglewski B.H and Clark V.L “Molecular basis of Bacterial Pathogenesis”, Academic Press, 1990.
2. Peter Williams, Julian Ketley & George Salmond, “Methods in Microbiology: Bacterial Pathogenesis, Vol. 27”, Academic Press, 1998.

REFERENCES

1. Recent reviews in Infect. Immun., Mol. Microbiol, Biochem. J., EMBO etc.
2. Nester, Anderson, Roberts, Pearsall, Nester, “Microbiology: A Human Perspective”, McGraw-Hill, 3rd Edition, 2001.
3. Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.

BT1015 METABOLIC ENGINEERING 3 0 0 100

AIM

To develop skills of the students in the area of Metabolic Engineering.

OBJECTIVES

At the end of the course, the student would have learnt about Biosynthesis of primary & secondary metabolites, Bioconversion etc and its relevance to Industrial applications.

UNIT I INTRODUCTION 15

Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amnio acid regulation of rna synthesis,

energy charge, regulation, amino acid regulation of rna synthesis, energy charge, regulation, premeability control passive diffusion, active transport group transportation.

UNIT II SYNTHESIS OF PRIMARY METABOLITES 7

Alteration of feed back regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability, metabolites.

UNIT III BIOSYNTHESIS OF SECONDARY METABOLITES 9

Precursor effects, prophophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

UNIT IV BIOCONVERSIONS 4

Advantages of bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or seqencial bioconversions, conversion of insoluble substances.

UNIT V REGULATION OF ENZYME PRODUCTION 10

Strain selection, improving fermentation, recognising growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.

TOTAL : 45

TEXT BOOKS

1. Wang D.I.C., Cooney C.L., Demain A.L., Dunnil.P., Humphery A.E., Lilly M.D., "Fermentation And Enzyme Technology", John Wiley And Sons., 1980.
2. Stanbury P.F., And Whitaker A., "Principles Of Fermention Technology", Pergamon Press, 1984.

REFERENCE

1. Zubay G., " Biochemistry ", Macmillan Publishers, 1989.

BT1016 GENOMICS AND PROTEOMICS 3 0 0 100

AIM

To develop skills of students in the area of Genomics and Proteomics.

OBJECTIVES

At the end of the course the student would have gained knowledge in physical mapping techniques, overview of various genomes, techniques applied in Proteomics & Genomics and functional Genomics. This will be very useful in the area of vaccine design.

UNIT I OVERVIEW OF GENOMES OF BACTERIA, ARCHAE AND EUKARYOTA 9

Organisation of genes, coding non-coding chromosomes and high order structures, genomes relatedness.

UNIT II PHYSICAL MAPPING TECHNIQUES 9

Top down and bottom up approach; linking and jumping of clones; genome sequencing; placing small fragments on map; STS assembly; gap closure; pooling strategies; cytogenetic mapping techniques.

UNIT III FUNCTIONAL GENOMICS 9

Gene finding; annotation; ORF and functional prediction; Substractive DNA library screening; differential display and representational difference analysis; SAGE; TOGA.

UNIT IV PROTEOMICS TECHNIQUES 9

Protein level estimation; Edman protein microsequencing; protein cleavage; 2 D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels; pattern analysis; Mass spectrometry- principles of MALDI-TOF; Tandem MS-MS; Peptide mass fingerprinting.

UNIT V PROTEIN PROFILING 9

Post translational modification; protein-protein interactions; glycoprotein analysis; phosphoprotein analysis.

TOTAL : 45

TEXT BOOKS

1. Cantor and Smith, Genomics. John Wiley & Sons, 1999.
2. Pennington and Dunn, Proteomics, BIOS Scientific Publishers, 2001

REFERENCES

1. Liebler, Introduction to Proteomics, Humana Press, 2002
2. Hunt and Livesey, Functional Genomics, Oxford University press, 2000
3. Primrose and Twyman, principles of genome analysis and genomics, Blacwell Publishing Co., 2003.

BT1017 NEUROBIOLOGY AND COGNITIVE SCIENCES 3 0 0 100

AIM

To develop the skills of students in the area of macrobiology and cognitive sciences.

OBJECTIVES

At the end of the course, the student would have learnt about the human nervous system, neurophysiology & nuurophaemacology. The student also gains knowledge in the mechanisms of neurological behaviour.

UNIT I NEUROANATOMY 9

What are central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

UNIT II NEUROPHYSIOLOGY 9

Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

UNIT III NEUROPHARMACOLOGY 9

Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; characteristics of neurites; hormones and their effect on neuronal function.

UNIT IV APPLIED NEUROBIOLOGY 9

Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.

UNIT V BEHAVIOUR SCIENCE 9

Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.

TOTAL : 45

TEXT BOOK

1. Mathews G.G. Neurobiology, 2nd edition, Blackwell Science, UK, 2000.

BT1018 BIOPROCESS ECONOMICS AND PLANT DESIGN 3 0 0 100

AIM

To develop skills of the students in the area of Bioprocess Economics and Plant Design.

OBJECTIVES

At the end of the course, the student would have learnt about Business organizations, project design and development, Economics of plant Design and Quality control requirements.

UNIT I PROCESS ECONOMICS AND BUSINESS ORGANIZATIONS 10

Definition of Bio Process, Bio Process Economics, Importance of various M-inputs-Globalization concept-Competition by Dumping-It's effect on Plant size-Status of India with adjoining ASEAN countries (Singapore, Malaysia, Indonesia etc)-Project profile concept-details; Structure and Types of Organizations; Simple Management Principles.

UNIT II PROJECT DESIGN AND DEVELOPMENT 10

Choosing a Project, Market Survey, Importance of Techno-Economic-Viability Studies, Sourcing of Processes, Process alternatives, Fixing most economic processes, Technology-Scanning, Plant Location Principles, Plant Lay out, Process Flow sheets, Preparation of Budgetory investment and production costs.

UNIT III COST ESTIMATION, PROFITABILITY AND ACCOUNTING 10

Capital investment, Concept of time-Value of money, Source Sink concept of Profitability, Capital Costs, Depreciation, Estimation of Capital costs, Manufacturing Costs, Working Capital; Profitablity Standards, Project profitability evaluation, Alternative investments and Replacements; Annual reports, Balance Sheets, Performance Analysis.

UNIT IV PROCESS OPTIMIZATION TECHNIQUES 6

Optimum design-Design Strategy, Economic-Balance, Different unit-Operations with Single and Multiple Variables.

UNIT V QUALITY AND QUALITY CONTROL 9

Current good manufacturing practices. Concepts of Quality Control in 20th century; Elements of quality control envisaged by ISI since 1947; Emergence of Statistical Process Control (SPC), Simple SPC concept details, Fundamental Concepts of ISO 9000 Quality System and the various requirements for ISO certification.

TOTAL : 45

TEXT BOOKS

1. Peters M.S., Klaus D. Plant Design and Economics for Chemical Engineers. McGraw-Hill International Edition, Chemical Engineering series, 1991.
2. Senapathy R. Text Book of Principles of Management and Industrial Psychology. Lakshmi Publications, 2001.

REFERENCE

1. Rudd and Watson. Strategy for Process Engineering, Wiley Publications.1987.