COURSE STRUCTURE
&
SYLLABUS
(3rd – 8th SEMESTER)
FOR B.TECH PROGRAMME
IN
BIOTECHNOLOGY

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY ORISSA,
ROURKELA

2007 - 2008
### Course Structure
#### Second Year Year B.Tech Programme
##### Biotechnology

#### 3rd Semester

<table>
<thead>
<tr>
<th>Theory</th>
<th>Contact Hrs.</th>
<th>Credit</th>
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<tbody>
<tr>
<td><strong>L-T-P</strong></td>
<td></td>
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<tr>
<td>BSCM 2201 Mathematics - III</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td>CPME 6208 Fluid Mechanics &amp; Machines</td>
<td>3-1-0</td>
<td>4</td>
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<tr>
<td>BSCP 2201 Physics - II / BSCP 2202 Physics of Semi-Conductor Devices or BSCC 2201 Chemistry - II / BSCC 2202 Material Sciences</td>
<td>3-0-0</td>
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<tr>
<td>BSCP 2201 Physics - II / or BSCC 2201 Chemistry - II / BSCC 2202 Material Sciences</td>
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<td>BCSE 3201 Object Oriented Programming</td>
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<tr>
<td>HSSM 4201 Engineering Economics &amp; Costing or HSSM 4202 Organisational Behaviour</td>
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<tr>
<td>CPBT 7201 Biochemistry</td>
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<td><strong>Total</strong></td>
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#### 4th Semester

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<td><strong>L-T-P</strong></td>
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<tr>
<td>CPBT 7202 Cell Biology &amp; Genetics</td>
<td>3-1-0</td>
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<tr>
<td>CPBT 7203 Microbiology</td>
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<tr>
<td>BSCC 2201 Chemistry - II / BSCC 2202 Material Sciences</td>
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<td>CPBT 7202 Cell Biology &amp; Genetics</td>
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<tr>
<td>CPBT 7203 Microbiology</td>
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<td>BSCC 2201 Chemistry - II / or BSCC 2202 Material Sciences</td>
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<td>BCSE 3202 Relational Database Management System</td>
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<tr>
<td>HSSM 4202 Organisational Behaviour or HSSM 4201 Engineering Economics &amp; Costing</td>
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<tr>
<td>CPBT 7204. Molecular Biology</td>
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#### Practicals/Sessionals

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<th>Contact Hrs.</th>
<th>Credit</th>
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<tr>
<td>BENG 9202 Basic Electronics Laboratory or BENG 9201 Basic Electrical Engineering Laboratory</td>
<td>0-0-3</td>
<td>2</td>
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<tr>
<td>BCSE 9201 OOPs Computer Lab</td>
<td>0-0-3</td>
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<tr>
<td>BENG 9203 Mechanical Engineering Laboratory</td>
<td>0-0-3</td>
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<tr>
<td>CPBT 9201 Biochemistry Lab.</td>
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#### Total

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<tr>
<td><strong>Total</strong></td>
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</table>
Module - I (9 Lectures)
Partial differential equations : The vibrating string. The wave equation & its solution.
The Heat equation and its solution

Module - II (10 Lectures)
Two - dimensional wave equation and its solution.
Laplace equation in polar, cylindrical and spherical coordinates. Potential.

Module - III (13 Lectures)
Complex analysis : Complex numbers and functions conformal mappings
Complex integration. Cauchy’s Theorem Cauchy’s integral formulas.

Module - IV (8 Lectures)
Taylor’s and Laurent’s series, Residue theorem, evaluation of real integrals.

The Course covered by : Advance Mathematics by E. Kreyszig, John Wiley & Son’s (P) Ltd. (8th Edition)
Chapter 11 (except 11.6)
Chapter 12, 13, 14, 15

CPME 6208 - FLUID MECHANICS AND HYDRAULIC MACHINE (3-1-0)

Module – I
Introduction : Scope of fluid mechanics and its development as a science
Physical property of Fluid
Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

Fluid static
Pressure, Pascal’s Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, monometer.
Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface.

Module – II
Buoyancy and flotation, Archimedes’ principle, stability of immersed and floating bodies, determination of metacentric height.
Fluid dynamics : Introduction, Euler’s equation along a streamline, energy equation, Bernoulli’s equation, Analysis of finite control volumes and its application to siphon, venture meter, orifice meter

Module – III
Turbine : Classification, reaction, Impulse, outward flow, inward flow and mixed flow turbines, Francis & Kaplan turbines, Pelton wheel, Physical description and principle of operation, Governing of Turbine.

Module – IV
Centrifugal Pump : Principles of classification, Blade angles, Velocity triangle, efficiency, specific speed, characteristics curve.
Reciprocating Pump: Principles of working, slip, work done, effect of acceleration and frictional resistance, separation

Text Books
1. Fluid Mechanics, A.K. Mohanty, PHI
3. Fluid Mechanics, Modi & Seth

BSCP 2201 PHYSICS - II (3-0-0)

This one semester Physics course is divided into four units. The unit - I deals with some aspects of nuclear physics, unit - II introduces certain features of condensed matter physics, unit - III deals with certain aspects of semiconductors and superconductors and unit - IV introduces Opto-electronic devices and fibre-optic communication system.

Unit - 1
This unit covers the basic principles and applications of different types of accelerators and their important applications.

Detailed constructional features of accelerators are not necessary.
1. Need for nuclear accelerators.
3. RF accelerators: Linear accelerator, cyclotron, electron accelerator, betatron.

Unit - 2
This Unit deals with diffraction in crystals and its role in determining crystal structure.
Study of crystal structure by diffraction methods, Bragg’s condition for crystal diffraction, Lau condition, Miller indices, Reciprocal lattice, Geometrical structure factor, Atomic form factor.

Unit - 3
This unit deals with certain features of semiconductors and superconductors.
2. Superconductivity: Superconductors and their properties, Meisner effect, Type - I and Type - II Superconductors, Thermodynamic properties of superconductors, London equation, Application of superconductors.

Unit - 4
This unit introduces some Opto-electronic devices and fibre-optic communication system.
LED: Principle construction of operation and application, Introduction to fibre optics, basic characteristics of optical fibres, optical fibre communication system.

Books Recommended
1. Nuclear Physics, P. R. Roy & B. P. Nigan
2. Particle Accelerators, M. S. Livingston & J. P. Blewett
3. Concepts of Modern Physics, A. Beiser
Module I (9 Hours)
An appreciation of Quantum Mechanic in determining electrical properties of semiconductor.

The Semiconductor in Equilibrium:
Equilibrium distribution of electrons & holes, the n0 and p0 equation, intrinsic carrier concentration; Dopant atoms and energy levels, ionization energy; the extrinsic semiconductor, the n0 p0 product, position of Fermi-energy level, variation of EF with doping concentration and temperature.

Carrier Transport Phenomena:
Carrier drift: mobility, conductivity, velocity saturation:
Carrier Diffusion: Diffusion current density. Total current density. The Einstein relation.

Module II (9 Hours)
Non-equilibrium Excess Carrier in Semiconductor
Excess carrier generation and recombination, characteristics of excess carriers-continuity equation and time – dependent Diffusion equation. Ambipolar Transport – Derivation of equation and applications.

The Pn junction and Diode
Basic structure, built-in potential barrier, Electric field, space charge width; Reverse applied bias-space charge width and Electric field. Junction capacitances.
Pn junction Diode : Ideal – current voltage relationship, Minority Carrier distribution, Ideal Pn junction currents under forward and reverse bias.

Module III (9 Hours)
Pn junction diode (contd.):
Temperature effects, Small signal model of Pn junction, Equivalent circuits Recombination Current. Junction Breakdown.

Metal-Oxide- Semiconductor FET (MOSFET)
The MOS structure : Energy band diagrams, Depletion Layer thickness, Work function difference, Flat band Voltage, Threshold Voltage, Charge distribution, Capacitance –Voltage characteristics.

The basic MOSFET operation, Current –Voltage relation (Concepts)
Frequency limitation : Small signal Equivalent circuit.
The CMOS Technology.

Module IV (8 Hours)
The Bipolar Transistor

Text Book:
Module I (12 Lectures)
(To develop awareness about Water Treatment)
Water quality parameters and standards.
Hardness of Water: Types of hardness, Units of hardness, Determination of hardness.
Disadvantages of hardwater, acidity and alkalinity, Water Softening Techniques. Boiler feed water, Water for Domestic purposes (municipal / Drinking Water)

Module II (10 Lectures)
(To develop the basic concepts about the transition metal compounds and corrosion)
1. Corrosion:
   Dry and wet corrosion, Galvanic Corrosion, Stress Corrosion, Factors affecting corrosion,
   Corrosion Control: (Proper design and fabrication procedure, Cathodic protection, Passivation).
   (8 Lectures)
2. Polymers:
   (8 Lectures)

Module III (10 Lectures)
(To introduce the students about the basic concepts of fuels)
1. Fuels:
   Classification of fuels, calorific value, Analysis of Coal and Coke, Refining of Crude oil, Fractional distillation, Cracking, Knocking and antiknocking, Octane and Cetane number.
   Gaseous Fuel: Producer gas, Water gas, LPG & CNG.
   Combustion Calculation.

Module IV (10 Lectures)
(To develop awareness amongst the students about the importance of water quality in domestic and industrial world and concepts of various kinds of pollutions)
1. Water Treatment:
   Water quality parameters and standards, treatment of water for industrial and domestic purpose.
2. Environment pollution:
Green house effect, acid rain, depletion of ozone layer; Water pollution- bio chemical effect of lead, arsenic, mercury and fluorides, sewage-B.O.D. and C.O.D.

Books:
2. Organic Chemistry by Solomons and Fryhle, Wiley Publishing
3. Guide to Organic Reaction Mechanism by Peter Sykes
4. Concise Inorganic Chemistry by J. D. Lee, 4th/5th Ed. ELBS

BSCC 2202 MATERIAL SCIENCES (3-0-0)

MODULE - I (10 Lectures)

MODULE - II (10 Lectures)
5. Dielectric Materials : Microscopic Displacement of atoms and molecules in an external dc electric field, Polarization and dielectric constant, Dielectric susceptibility. Temperature dependence, Dielectric Breakdown. Ferro electric material Piezoelectrics, Pyroelectrics, Dielectric Materials as electrical isulators.

MODULE - III (8 Lectures)
MODULE - IV (8 Lectures)


10. Ceramics: Types, Structure, Mechanical properties, applications


Text Books:

2. Vijaya M. S., Rangarajan G, Materials Science, TMH
3. Rajendra V., Marikani A., Materials Science, TMH
4. Van Vlack L. H., Elements of Material Science and Engineering, Addison Wesley

BCSE 3201 OBJECT ORIENTED PROGRAMMING USING C++ (3-0-0)

Module I (10 Hours)

Introduction to object oriented programming, user defined types, polymorphism, and encapsulation.
Getting started with C++ -syntax, data-type, variables, strings, functions, exceptions and statements, namespaces and exceptions, operators. Flow control, functions, recursion. Arrays and pointers, structures.

Module II (10 Hours)

Abstraction mechanisms: Classes, private, public, constructors, member functions, static members, references etc. Class hierarchy, derived classes.
Inheritance: simple inheritance, polymorphism, object slicing, base initialization, virtual functions.

Module III (12 Hours)

Prototypes, linkages, operator overloading, ambiguity, friends, member operators, operator function, I/O operators etc.
Memory management: new, delete, object copying, copy constructors, assignment operator, this input/output.
Exception handling: Exceptions and derived classes, function exception declarations, Unexpected exceptions, Exceptions when handling exceptions, resource capture and release etc.

Module IV (8 Hours)

Templates and Standard Template library: template classes, declaration, template functions, namespaces, string, iterators, hashes, iostreams and other type.
Design using C++ design and development, design and programming, role of classes.

Text Books:

1. Bhave & Patekar- Object oriented Programming with C++, Pearson Education
3. Robert Lafore- Object oriented programming in Microsoft C++.
4. Balguru Swamy-C++, TMH publication
HSSM 4201 ENGINEERING ECONOMICS AND COSTING (3-0-0)

Module I (10 Hours)
Time value of money : Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences.
Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, pay back period comparison.

Module II (10 Hours)
Use and situations for equivalent annual worth comparison, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. Analysis of public Projects : Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost –effectiveness analysis.

Module III (10 Hours)
Depreciation, Computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Sensitivity analysis: single and multiple parameter sensitivity.

Module IV (12 Hours)

Text Book
1. Horn green, C.T., Cost Accounting, Prentice Hall of India

HSSM 4202 ORGANIZATIONAL BEHAVIOUR (3-0-0)

Module I (8 Hours)
Learning – Nature of Learning, How Learning occurs, Learning and OB.
Case Analysis

Module II (10 Hours)
Foundations of Individual Behaviour : Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.
Case Analysis

Module III (12 Hours)
Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness. Groups in

Case Analysis

Module IV (10 Hours)
Case Analysis

TEXTBOOKS:
Keith Davis, Organizational Behaviour, McGraw – Hill.

REFERENCE BOOKS:
Stephen P. Robbins, Organizational Behaviour, Prentice Hall of India.

CPBT 7201 BIOCHEMISTRY (3-1-0)

Module I (10 Lectures)
Chemistry of amino acids, Carbohydrate, Lipids, Nucleoside, nucleotide, nucleic acid

Module II (10 Lecturers)
Biochemistry of Small molecules : Vitamins, Minerals, Hormones- Physiological functions, enzymes, co-enzymes- classification, mechanism

Module III (10 Lecturers)
Structure : Primary, Secondary, tertiary and quaternary structure of proteins, protein folding, nucleic acid structure a, b, and z forms of DNA.

Module IV (10 Lecturers)
Metabolism: Carbohydrate metabolism- Glycolytic pathway, TCA, Pentose phosphate, gluconeogenesis, glycogen metabolism, Oxidative phosphorylation, electron transport system.

Text Book
1. Principle of Bio-Chemistry – Lehinger, Nelson and Cox
2. Biochemistry of Biochemistry by L. Stryer
3. Fundamentals of Biochemistry – Voet & Voet
4. Biochemistry by Zubay

PRACTICALS

BENG 9202 BASIC ELECTRONICS LABAROTARY (0-0-3)

(At least 8 experiments including 1 - 7 and any one from 8 - 10)

1. Familiarity with electronics components and Devices
   Testing of a semiconductor Diode and a Transistor. IC pins connection (Digital Multimeter should be used should be used in testing components and devices).
1. Study and measurement the armature and field resistance of a DC machine.
2. Calibration of ammeter, voltmeter and wattmeter with the help of sub-standard instrument.
3. Verification of circuit theorems. Thevenin’s and Superposition theorems (with DC source only).
4. Voltage-current characteristics of incandescent lamps and fusing time-current characteristics of fuse wire.
5. Measurement of current, voltages and power in R-L-C series circuit excited by Single Phase AC supply.
6. Connection and starting of a three phase induction motor using direct online (DOL). or star-delta starter.
7. Connection and measurement of power consumption of a fluorescent lamp.
8. Determination of open circuit characteristics (OCC) of DC machine.
10. Connection and testing of a single phase energy meter (unity power factor load only).
11. Study of fan motor

BENG 9201 BASIC ELECTRICAL ENGINEERING LABORATORY (0-0-3)

List of Experiment (Any 8 of the following)
1. Study and measurement the armature and field resistance of a DC machine.
2. Calibration of ammeter, voltmeter and wattmeter with the help of sub-standard instrument.
3. Verification of circuit theorems. Thevenin’s and Superposition theorems (with DC source only).
4. Voltage-current characteristics of incandescent lamps and fusing time-current characteristics of fuse wire.
5. Measurement of current, voltages and power in R-L-C series circuit excited by Single Phase AC supply.
6. Connection and starting of a three phase induction motor using direct online (DOL). or star-delta starter.
7. Connection and measurement of power consumption of a fluorescent lamp.
8. Determination of open circuit characteristics (OCC) of DC machine.
10. Connection and testing of a single phase energy meter (unity power factor load only).
11. Study on CMOS logic Inverter.

BCSE 9201 OOP WITH C++ LABORATORY (0-0-3)

(10 classes for 10 different programs)
1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using polymorphism.(1 class)
4. Programs on use of operator overloading.(1 class)
5. Programs on use of memory management.(1 class)
6. Programs on exception handling and use of templates.(1 class)
7. Programs on File handling in C++. (1 class)
BENG 9203 MECHANICAL ENGINEERING LABORATORY (0-0-3)

Group A (Mechanics / Material Testing Lab.)
1. Determination of equilibrium of coplanar forces.
2. Determination of Moment of Intertia of Flywheel

Group B
4. Determination of Metacentric Height and application to stability of floating bodies.
5. Verification of Bernoulli’s Theorem and its application to Venturimeter.

Group C
7. Calibration of Bourden Type Pressure gauj and measurement pressure using manometers.
8. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.

CPBT 9201 BIOCHEMISTRY LABORATORY (0-0-3)

No of Experiments
1-3 Separation of Amino Acids/ Lipids/ Sugar by TLC
4-5 Isolation of proteins and separation by PAGE
6-9 Assay of enzyme activity – protease from bacteria, Phosphatase from rat liver, Glucose oxidise.
10-12 Inhibitor studies (using fluoride, heavy metal, competitive inhibitors
13 determination of Km and Vmax
Module I (10 Lectures)
General methods of catabolism of amino acids and proteins. Protein degradation and turn over, catabolism of lipids α, β and γ obsolescense. Purine and Pyrimidine metabolism. Integration of metabolism.

Module II (10 Lectures)
Biosynthesis of amino acids (valine, serine and histidine, glutamic acid), Biosynthesis of lipids (saturated and unsaturated) purine and pyrimidines

Module III (18 Lectures)
Cell membrane and organelles, transport across cell membrane, receptors, protein, targeting, cell cycles.

Module IV (12 Lectures)
Classical Genetics- Physical basis of inheritance (Mandelian Principles) gene interaction, alleles, complementation, linkage, recombination and chromosome mapping, sex determination, chromosome characterization, (chromosomal aberration), population genetics, genetic equilibrium, changes in gene frequency, human genome.

Text Books
1. Biochemistry - J. L. Jain, S. Chand & Company
5. Biochemistry by Zubay
6. Concept of Genetics by Klug
7. Genome by T.A Brown
8. Biochemistry by L. Stryer W.H. Freeman and company/Newyork
9. Gene VII by Lewin

Module I (10 Lectures)
General Microbiology – Introduction to Microbial Kingdom- bacteria, mold, yeast, algae virus, morphology, sub cellular structure, cell wall, sporulation, archaebacteria, and extremophiles, microbial taxonomy- modern approaches, Different microbial culture techniques – media, pure culture, isolation and preservation, staining, Gram staining, flagella, acid fast, capsules, spores

Module II (10 Lectures)
Growth - Microbial nutrition and physiology, phototrophs, heterotrophs, autotrophs and chemotrophs, sterilization, disinfections, growth kinetics and quantitative aspects, Monad’s equation, growth rates, continuous culture, synchronous and asynchronous growth.
Module III (10 Lectures)
Metabolism: Metabolism of Carbohydrate in aerobes and anaerobes, etner-doudroff and glyoxylate pathway, energy tranduction mechanism specific to prokaryotes, anaerobic respiration nitrogen metabolism (Nitrogen fixation, cyanobacteria) sulphur cycle.

Module IV (10 Lectures)
Microbial Genetic: Nutrition Spontaneous and induced, DNA repair, bacterial recombination, transformation, transduction, conjugation, transposons.

Text Books:
1. Text book of Microbiology by Stanier
2. Microbiology by Pelczar
3. Brock Biology of micro-organisms
4. Microbiology by Presscort.
5. Microbial Genetics- Freifelder
6. Mol. Genetic of bacteria by R. Snyder
7. Microbiology by Atlas
8. Microbiology by Devis

BSCC 2201 CHEMISTRY - II (3-0-0)

Module I (12 Lectures)
(To develop awareness about Water Treatment)
Water quality parameters and standards.

Module II (10 Lectures)
(To develop the basic concepts about the transition metal compounds and corrosion)
1. Corrosion:
   Dry and wet corrosion, Galvanic Corrosion, Stress Corrosion, Factors affecting corrosion, Corrosion Control: (Proper design and fabrication procedure, Cathodic protection, Passivation).
   (8 Lectures)
2. Polymers:
   (8 Lectures)

Module III (10 Lectures)
(To introduce the students about the basic concepts of fuels)
1. Fuels:
Classification of fuels, calorific value, Analysis of Coal and Coke, Refining of Crude oil, Fractional distillation, Cracking, Knocking and antiknocking, Octane and Cetane number.

Gaseous Fuel: Producer gas, Water gas, LPG & CNG.

Combustion Calculation.

**Module IV (10 Lectures)**

(To develop awareness amongst the students about the importance of water quality in domestic and industrial world and concepts of various kinds of pollutions)

1. **Water Treatment:**
   Water quality parameters and standards, treatment of water for industrial and domestic purpose.

2. **Environment pollution:**
   Green house effect, acid rain, depletion of ozone layer; Water pollution- bio chemical effect of lead, arsenic, mercury and fluorides, sewage-B.O.D. and C.O.D.

**Books:**

2. Organic Chemistry by Solomons and Fryhle, Wiley Publishing
3. Guide to Organic Reaction Mechanism by Peter Sykes
4. Concise Inorganic Chemistry by J. D. Lee, 4th/5th Ed. ELBS

**BSCC 2202 MATERIAL SCIENCES (3-0-0)**

**MODULE - I (10 Lectures)**


**MODULE - II (10 Lectures)**


**MODULE - III (8 Lectures)**


Plastics - Types: Thermosetting and thermoplastics.

**MODULE - IV (8 Lectures)**


10. Ceramics: Types, Structure, Mechanical properties, applications.


**Text Books:**

2. Vijaya M. S., Rangarajan G, Materials Science, TMH
3. Rajendra V., Marikani A., Materials Science, TMH
4. Van Vlack L. H., Elements of Material Science and Engineering, Addison Wesley

**BSCP 2201 PHYSICS - II (3-0-0)**

This one semester Physics course is divided into four units. The unit - I deals with some aspects of nuclear physics, unit - II introduces certain features of condensed matter physics, unit - III deals with certain aspects of semiconductors and superconductors and unit - IV introduces Opto-electronic devices and fibre-optic communication system.

**Unit - 1**

This unit covers the basic principles and applications of different types of accelerators and their important applications.

Detailed constructional features of accelerators are not necessary.

1. Need for nuclear accelerators.
3. RF accelerators: Linear accelerator, cyclotron, electron accelerator, betatron.

**Unit - 2**

This Unit deals with diffusion in crystals and its role in determining crystal structure.
Study of crystal structure by diffraction methods, Bragg’s condition for crystal diffraction, Lau condition, Miller indices, Reciprocal lattice, Geometrical structure factor, Atomic form factor.

Unit - 3
This unit deals with certain features of semiconductors and superconductors.

2. Superconductivity: Superconductors and their properties, Meisner effect, Type - I and Type - II Superconductors, Thermodynamic properties of superconductors, London equation, Application of superconductors.

Unit - 4
This unit introduces some Opto - electronic devices and fibre - optic communication system.
LED: Principle construction of operation and application, Introduction to fibre optics, basic characteristics of optical fibres, optical fibre communication system.

Books Recommended
1. Nuclear Physics, P. R. Roy & B. P. Nigan
2. Particle Accelerators, M. S. Livingston & J. P. Blewett
3. Concepts of Modern Physics, A. Beiser
4. Introduction to Solid State Physics, C. Kittel
5. Introduction to Lasers, A. Avadhnulu

BSCP 2202 PHYSICS OF SEMICONDUCTOR DEVICES (3-0-0)

Module I (9 Hours)
An appreciation of Quantum Mechanics in determining electrical properties of semiconductor.

The Semiconductor in Equilibrium:
Equilibrium distribution of electrons & holes, the n0 and p0 equation, intrinsic carrier concentration; Dopant atoms and energy levels, ionization energy; the extrinsic semiconductor, the n0 p0 product, position of Fermi-energy level, variation of EF with doping concentration and temperature.

Carrier Transport Phenomena:
Carrier drift: mobility, conductivity, velocity saturation:
Carrier Diffusion: Diffusion current density. Total current density. The Einstein relation.

Module II (9 Hours)
Non-equilibrium Excess Carrier in Semiconductor
Excess carrier generation and recombination, characteristics of excess carriers-continuity equation and time – dependent Diffusion equation. Ambipolar Transport – Derivation of equation and applications.
The Pn junction and Diode
Basic structure, built-in potential barrier, Electric field, space charge width; Reverse applied bias-space charge width and Electric field. Junction capacitances.
Pn junction Diode: Ideal – current voltage relationship, Minority Carrier distribution, Ideal Pn junction currents under forward and reverse bias.

Module III (9 Hours)

Pn junction diode (contd.):
Temperature effects, Small signal model of Pn junction, Equivalent circuits Recombination Current. Junction Breakdown.

Metal-Oxide-Semiconductor FET (MOSFET)
The MOS structure: Energy band diagrams, Depletion Layer thickness, Work function difference, Flat band Voltage, Threshold Voltage, Charge distribution, Capacitance –Voltage characteristics.

The basic MOSFET operation, Current –Voltage relation (Concepts)
Frequency limitation: Small signal Equivalent circuit.
The CMOS Technology.

Module IV (8 Hours)
The Bipolar Transistor

Text Book:
1. Semiconductor Physics and Devices - Basic Principles BY Donald A. Neamen, 3rd Edition, Tata McgrawHill Edition. (Selected portion from chapters 2, 4, 6, 7, 8, 9, 10 & 11.)

For additional reading

BCSE 3202 RELATIONAL DATABASE MANAGEMENT SYSTEMS (3-0-0)

Module I (10 Hours)
Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages.
Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II (10 Hours)
Relation Query Languages, Relational Algebra, Tuple and Domain Relational Calculus, SQL and QBE.
Relational Database Design: Domain and Data dependency, Armstrong’s Axioms, Normal Forms, Dependency Preservation, Lossless design, Comparison of Oracle & DB2

Module III (8 Hours)
Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms.
Module IV (12 Hours)


Advanced topics: Object-Oriented and Object Relational databases, Logical Databases, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

Text Books:-
2. C.J.Date - An introduction to Database Systems, Pearson Education

HSSM 4202 ORGANIZATIONAL BEHAVIOUR (3-0-0)

Module I (8 Hours)


Learning – Nature of Learning, How Learning occurs, Learning and OB.

Case Analysis

Module II (10 Hours)

Foundations of Individual Behaviour: Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.


Case Analysis

Module III (12 Hours)


An Introduction to Transactional Analysis (TA).

Case Analysis

Module IV (10 Hours)


Case Analysis
TEXTBOOKS:
Keith Davis, Organizational Behaviour, McGraw – Hill.

REFERENCE BOOKS:
Stephen P. Robbins, Organizational Behaviour, Prentice Hall of India.

HSSM 4201 ENGINEERING ECONOMICS AND COSTING(3-0-0)
Module I (10 Hours)
Time value of money : Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences.
Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, pay back period comparison.

Module II (10 Hours)
Use and situations for equivalent annual worth comparison, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. Analysis of public Projects : Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost –effectiveness analysis.

Module III (10 Hours)
Depreciation, Computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Sensitivity analysis: single and multiple parameter sensitivity.

Module IV (12 Hours)

Text Book
1. Horn green, C.T., Cost Accounting, Prentice Hall of India

CPBT 7204 MOLECULAR BIOLOGY (3-1-0)
Module I (10 Lectures)
Biochemical Basis of inheritance –DNA as genetic material, Central dogma in molecular biology, replication in prokaryotes and eukaryotes, enzymes involved in DNA replication nucleotide sequence composition, Unique, middle and highly repetitive DNA, DNA sequencing – Max and Gillbert and Sanger’s.

Module II & III (20 Lectures)
RNA – concepts of transcription, discovery of messenger RNA, mechanism of transcription in prokaryote and eukaryotic system, enzymes and accessory factors involved in the transcription process, regulation of Gene expression, in prokaryotes and eukaryotes, concepts of translation –
genetic code, quantitative aspects of the process of translation. Gene silencing at the level of
transcription and translation.

Module IV (10 Lectures)

Recombinant DNA Technology: Concepts of recombinant DNA technology, type I, II and III restriction
modification system. Type II endonucleases, nomenclature and sequence recognitions, DNA
modification enzymes, ligase, (both quantitative and qualitative aspects), cloning – Vectors, plasmids,
bacteriophage, viral vectors, cosmids, Ti plasmids, phasmids, stuttle vectors, yeast vectors, BAC or
PAC. Use of Kleno enzyme Tu DNA polymerase, alkaline phosphatase, polynucleotide Kinase,
methods of screening of recombinant clones, genomic DNA library, CDNA library, hybridization
techniques – Southern, northern and colony hybridization, restriction mapping.

Books :
4. Principles of Mol. Biology - OS Prim Rose
5. Recombinant DNA Technology – Watson

PRACTICALS

BENG 9201 BASIC ELECTRICAL ENGINEERING LABORATORY (0-0-3)

List of Experiment (Any 8 of the following)
1. Study and measurement the armature and field resistance of a DC machine.
2. Calibration of ammeter, voltmeter and wattmeter with the help of sub-standard instrument.
3. Verification of circuit theorems. Thevenin’s and Superposition theorems (with DC source
   only).
4. Voltage-current characteristics of incandescent lamps and fusing time-current characteristics
   of fuse wire.
5. Measurement of current, voltages and power in R-L-C series circuit excited by Single Phase
   AC supply.
6. Connection and starting of a three phase induction motor using direct online (DOL). or star-
   delta starter.
7. Connection and measurement of power consumption of a fluorescent lamp.
8. Determination of open circuit characteristics (OCC) of DC machine.
10. Connection and testing of a single phase energy meter (unity power factor load only)
11. Study of fan motor

BENG 9202 BASIC ELECTRONICS LABARATORY (0-0-3)

(At least 8 experiments including 1 - 7 and any one from 8 - 10)

1. Familiarity with electronics components and Devices
   Testing of a semiconductor Diode and a Transisitor. IC pins connection (Digital Multimeter
   should be used should be used in testing components and devices).
2. Study and use of Oscilloscope to view waveforms and measure its amplitude and frequency.
4. Half wave and Full wave rectifiers without and with capacitor filter. Record of waveforms,
   Measurement of Average and rms values.
5. V - I Characteristics of anpn or pnp transistor. DC Biasing and measurement of dc voltages
   and currents.
7. Op amp in Inverting, non inverting, Integrating and Differentiating configuration, Record of wave forms.
8. Truth Tables of logic gates.
9. Study and experiment using MUX - DEMUX ICs / Shift Register IC.
10. Study on CMOS logic Inverter.

BCSE 9202 RDBMS LABORATORY (0-0-3)
(10 Classes for 10 Different Programs)

1. Use of SQL syntax : Insertion, Deletion, Join), Updation using SQL. (1 class)
2. Program segments in embedded SQL using C as host language to find average grade point of a student, etc.. (1 class)
3. Program for Log based data recovery technique. (1 class)
4. Program on data recovery using check point technique. (1 class)
5. Concurrency control problem using lock operations. (1 class)
6. Use of package (ORACLE) for programming approaches(2 classes)
7. Use of package (DB2) for programming approaches(2 classes)
8. Programs on JDBC/ODBC to print employee’s / student’s information of a particular department. (1 class)

CPBT 9202 MICROBIOLOGY LABORATORY (0-0-3)

1. Study of Autoclaving , preparation and sterilization of media solid and liquid/ (slant, stab and broth culture), complex and synthetic media.
2. Isolation of microorganism from natural habitat (air, water, soil, spoiled fruits and vegetable).
3. Isolation and pure culture by dilution plating and streaking.
4. Study of compound and phase –contrast microscope.
5. Simple staining, Gram Staining, Endospore staining, fungal staining.
7. Study of biochemical activity of microorganism starch hydrolysis, casein, hydrolysis, IMVIC text.
8. Sterilization of antibiotics by filtration and assay by zone inhabitation.
9. MIC determination of antibiotics.
10. Chemical assay of penicillin.

CPBT 9203 CELL AND MOLECULAR BIOLOGY LABORATORY (0-0-3)

1. Spectroscopic analysis of protein, DNA, RNA (Visible and UV)
2. Isolation of plasmid DNA and analysis by gel electrophoresis.
3. Transformation using plasmid DNA.
4. Isolation of genomic DNA – Bacteria, plant animal, quantitation and analysis by agarose gel electrophoresis.
5. Isolation of auxotrophic mutant –spontaneous and induced using (a) UV (b) chemical mutagen.
6. Restriction digestion and analysis using agarose gel electrophoresis.
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**L-Lecture**

**T-Tutorial**

**P-Practical**
5th Semester

CPBT 8301 UNIT OPERATIONS-1 UPSTREAM PROCESSING (3-1-0)

Module I  10 hours


Module II  10 hours

Flow measurements and machineries: Flow through pipes and open channels, Orifice and Venturi meters, Pitot Tube, Weirs, Rotameters and other types of meters, Transportation of fluids, Pipe Fittings and valves, Pumps – classification, centrifugal and positive displacement type – peristaltic. Blowers and Compressors (oil-free)

Module III  10 hours


Module IV  10 hours

Mechanical Operations: Principles of comminution, Types of comminuting equipment. Energy and power requirement, Crushers, Grinders, Mixing and Agitations, Power consumption in mixing, Mechanical separation, Screening, Types of screen, Filtration, Principle, Constant pressure and constant rate filtration, Settling classifiers, Floatation, Centrifugal Separations.

Books:
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition
3. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
4. Heat Transfer: D.Q.Kern, MGH
5. Badger, W.L.,Banchero, J.T., Introduction to Chemical Engineering, MGH
7. Perry, Chilton & Green, Chemical Engineers’ Handbook, MGH

CPBT 8302 INDUSTRIAL MICROBIOLOGY & ENZYME TECHNOLOGY (3-1-0)

Module I  10 hours

Microbial Processes: Microbiological processes for production of organic acids; solvents; antibiotics, enzymes, polysaccharides; lipids; pigments and aroma. Large scale production: Stationary, submerged, solid and semi-solid culture.

Module II  10 hours

Commercial strain development: Induced mutation, over producing decontrolled mutants, genetically engineered strain, Application of Biocatalyst, Group transfer redox, Elimination, isomerization and rearrangement, C-C bond cleavage and fermentation.
Module III          10 hours

Module IV          10 hours
Reaction environment: Reaction environment rebuilding, chemical modification, intramolecular cross linking and immobilization.

Books
1. Industrial Microbiology, Prescott and Dunn,
3. Biochemical Engineering Fundamentals, Bailey & Olis. MGH.

CPBT 8303 STRUCTURAL BIOLOGY (3-0-0)

Module I
Macromolecules and supramolecular assemblies: types of macromolecules and biological systems, molecular assemblies, membrane, ribosome, extracellular matrix, Chromatin.

Module II
Macromolecular structural determination: Physical technique in proteins, nucleic acids and polysaccharides structure analysis- UV, IR, Fluorescence spectrophotmetry.

Module III
Structure determination using NMR spectroscopy

Module IV
Structure determination –Crystalography and X-Ray Diffraction.

Books
Crothers and Eisenberg: Physical chemistry application to life sciences, Benjamin Cummings, USA.

CPBT 8304 IMMUNOLOGY (3-0-0)

Module I          10 hours
The origin of Immunology: Inherent immunity; humoral and cell mediated immunity. Primary and secondary lymphoid organ : antigen, B cell, T cell and macrophages.

Module II          10 hours
Major Histocompatibility Complex (MHC) : antigen processing and presentation; synthesis of antibody and secretion.

Module III          10 hours
Molecular basis of Immunology: Molecular basis of antibody diversity, polyclonal and monoclonal antibody, complement, antigen-antibody reaction.

Module IV          10 hours
Immune response and tolerance: Regulation of immune response, immune tolerance; hyper sensitivity, autoimmunity; graft versus host reaction, Immuno- deficiency and immuno-proliferate diseases.

BOOKS

**CPBT 8305 BIO-CHEMICAL REACTION ENGINEERING (3-1-0)**

**Module I**  
10 hours

**Material Balance & Energy Balances:** Mathematical requisites – use of log-log and semi-log graph paper, triangular diagram, graphical differentiation and graphical integration, material balance without chemical reaction, material balance with chemical reaction, energy balance; enthalpy changes, heat of reaction and its temperature dependence, heats of solution and mixing, adiabatic flame temperature, use of psychometric charts.

**Module II**  
10 hours

**Basic Concepts:**

**Vapour/Liquid, Liquid/Liquid, Solid/Liquid and Solid/Vapour Equilibria:**

**Module III**  
10 hours

**Application of Thermodynamics:**
The Chemical Potential and Phase Equilibria Fugacity and Fugacity Coefficient: for pure species and solution; Generalised correlations for Fugacity, the Ideal Solution, Property Changes and Heat Effects of Mixing Processes. The Vapour-Compression Cycle, the Choice of Refrigerant, Absorption, Refrigeration and liquefaction: Low temperature cycle: Linde and Claude

**Module IV**  
10 hours

**Bio-chemical Reaction Engg.:** Bioreaction kinetics: Rate of chemical reaction; Interpretation of batch reactor data for simple and complex reactions. Kinetics of Enzyme catalyzed reactions for free and immobilized enzymes. – derivation of Michaelis-Menten equation, Briggs-haldane relationship, the determination and significance of kinetic constants, Lineweaver-burk and Eadie-Hofstee plot, principles of enzyme inhibition – Competitive, noncompetitive and uncompetitive.

**Text Books**
2. Basic Principles and Calculations in Chemical Engineering, Himmelbalu, Prentice Hall (I) 6th Ed.
5. Smith & Vanness, Thermodynamics for Chemical Engineers, MGH.
Elective 1 (3-0-0)

PEBT 8301 RENEWABLE ENERGY TECHNOLOGY

Module I
Biological fuel generation: Biomass as a renewable energy source; types of biomass—forest, agricultural and animal residues, industrial and domestic organic wastes; conversion of biomass to clean fuels and petrochemical substitutes by physicochemical and/or fermentation processes.

Module II
Sources of biomass; biogas from anaerobic digestion; thermal energy from biomass combustion ethanol from biomass.

Module III
Hydrogen production by photosynthetic bacteria, biophotolysis of water and by fermentation; Microbial recovery of petroleum by biopolymers (Xanthum gum), bisurfactants.

Module IV

Books
1) J.E. Smith – Biotechnology, 3rd ed. Cambridge Univ Press
2) S. Sarkar – Fuels and combustion, 2nd ed., University Press

PEBT 8302 BIOMETALLURGY (3-0-0)

Module I
Introduction to Biotechnology applied to Raw Material processing, Biogeochemical Reactions—chemical mechanisms and controlling factors, Microbial interventions, Nature and characteristics of Biogeochemically important micro-organisms.

Module II
Kinetics of bioleaching; Applications of biogeochemical processes in mining and metallurgy, dump, heap and in-situ leaching.

Module III
Reactor modeling for leaching, beneficiation of ores and process residues: recovery of gold and silver, beneficiation of sulfidic tailings from tin processing; purification of ferroginous sand.

Module IV
Beneficiation of Bauxite, applications of sulphate reducing bacteria, Environmental pollution control: accumulation of metals by microbial cells; growth of microbial cells in water flowing pipelines; microbial degradation of water-based metal working fluids.

References

**CPBT 9301 MOLECULAR BIOLOGY AND FERMENTATION TECHNOLOGY LAB**

(0-0-3)

Function of bioreactor.
Sterilization of air and calibration of DO electrode.
Manipulation of DO with airflow and stirrer speed regulation.
Preparation of inoculum and production of ethanol by *S.cerevisiae*.
Analysis of ethanol produced by enzymatic method.
Microbial growth of *S.cerevisiae* and production of ethanol.

**CPBT 9302 IMMUNOLOGY LAB. (0-0-3)**

1) Ouchterlony double diffusion technique
2) Radial immuno diffusion technique
3) Dot ELISA
4) Western Blotting technique

**CPBT 9303 UNIT OPERATION LAB – I (0-0-3)**

1. Experiments on Reynold’s Apparatus-Determination of flow regime and construction of friction factor against Nre.
2. Experiments on flow measuring device-in closed conduit using (a) Venturimeter, (b) Orifice meter (c) Roameter.
3. Determination of Pressure drop for flow through packed bed & verification of Ergun Equation, Kozeny-Karman equation, Blake-Plummer Equation.
4. To study the working characteristics of a Jaw Crusher, calculate the energy consumption as a function of size reduction and compare it with the actual energy requirements.
5. To study the working characteristics of a Ball Mill, calculate the energy consumption as a function of size reduction and determined the critical speed.
6. To Determine the Overall heat transfer coefficient of a concentric pipe heat exchanger based on the inside diameter of the tube.
7. To study the characteristics of film-wise/drop-wise condensation.
Module I
Equilibrium reaction in mass transfer: Introduction to mass transfer, Distillation, Extraction and absorption.

Module II
Basic concepts of bio separation Technology, Separation characteristics of proteins and enzymes-size, stability, properties; purification methodologies, Characteristics of bio-products; Flocculation and conditioning of broth, overview of reaction processes involved in separation, numerical examples illustrating the processes; Filtration at constant pressure and at constant rate; empirical equations for batch and continuous filtration, centrifugal and cross-flow filtration, Centrifugation: basic principles, design characteristics; Ultracentrifuges: Principles and applications.

Module III
Techniques involved in Separation Processes: Foam-fractionation; Solvent extraction of bio-processes, aqueous two-phase extraction, adsorption-desorption process; Salt precipitation; Chromatographic separation based on size, charge hydrophobic interactions and metal ion affinity. Affinity chromatography, inhibitors: their preparation and uses, method of linkages, Electrophoresis SDS-PAGE (Polyacrylamide Gel), horizontal and vertical type, methods, case studies.

Module IV
Drying and crystallisation; Batch drying, Principle and operation of spray dryer, preliminary idea of crystallisation; Membrane based separation processes: Microfiltration, reverse osmosis, Ultrafiltration.

Books
1. Schuler & Kargi: Bio process Engg. PHI

References:
1. Perry, Chilton & Green, Chemical engineers’ Handbook, MGH.

CPBT 8307 DNA TECHNOLOGY (3-1-0)

Module I
Expression of genes in prokaryotic and eukaryotic systems.
Gene structure in prokaryotic and eukaryotic cells
Gene expression – concept of operon and related elements in the unit, regulatory and structural gene, post transalational processing of mRNA, extra chromosomal DNA and its functions.

**Module II**

10 hours

Tools of rDNA technology

Restriction endonuclease and other enzymes, Vectors: bacteriophages. Cosmids, Triplasmids, yeast artificial chromosome and others, DNA labeling radioactive and nonradioactive methods, DNA sequencing, Southern and northern bloting in situ, DNA fingerprinting.

**Module III**

10 hours

Gene transfer technology


**Module IV**

10 hours

Application of rDNA technology

Antisense and ribozyme technology, Human genome project and its application, Gene therapy prospect and future, DNA vaccine, Transgenic plants, current production of rDNA products, Bio-safety measures and regulations for rDNA work.

References

2. S. Mahesh and A.B.Vedamurthy, Biotechnology-4 (rDNA technology, Environmental biotechnology, Animal cell culture), New age international publisher.

**CPBT 8308 PLANT BIOTECHNOLOGY (3-1-0)**

**Module I**

10 hours

Plant tissue culture – theory and methods:

Introduction of plant tissue culture and cell suspension culture, physio-chemical conditions for propagation of plant cells and tissues, composition of media, nutrient and hormone requirement, continuous culture, techniques for immobilization of plant cells, continuous product recovery system using immobilized plant cell system.

**Module II**

10 hours

Plant tissue culture- product and recovery:

Primary and secondary metabolic products (phytochemicals) of plant cells, biosynthesis of secondary metabolites of biotechnological importance, biotransformation for product development and selection of cell culture, process technology with salient features for specific products.

**Module III**

10 hours

Plant tissue culture and genetic engineering (a)

Structure and organization of plant genome, regulation of plant genome expression, transcriptional, translational and post translational regulation of plant genome. – Transposons, chloroplast and mitochondrial genome.

**Module IV**

10 hours

Plant tissue culture and genetic engineering (b)

Transfer of nucleic acid to plant cells
—Direct transformation by electroporation and particl gun bombardment.
—Agrobacterium, Ti plasmid vector

Theory and techniques for the development of new genetic traits, conferring resistance to herbicide, pesticide, plant pathogens.

Plant engineering towards development of enriched food products,
Plant growth regulators.

References

1. Slater, Plant Biotechnology, OUP

CPBT 8309 BIOINFORMATICS (3-0-0)

Module I 10 hours
Introduction to genomic data and data organization: Sequence data banks- Introduction to sequence data banks- protein sequence data bank. NBFR-PIR, SWISSPORT, Signal peptide data bank, Nucleic acid sequence data bank –Gen bank, EMBL nucleotide sequence data bank, AIDS Virus sequence data bank. RRNA data bank, structural data banks- protein Data bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank – Metabolic pathway data : Microbial and Cellular Data Banks.

Module II 10 hours
Introduction to MSDN (Mirobial Strain Data Network): Numerical coding systems of microbes, Hybridoma data Bank Structure, Virus Information System, Cell line Information system; other important Data Banks in the area of Biotechnology/life sciences/biodiversity.

Sequence Analysis: Analysis Tools for Sequence Data Banks: Pair wise alignment-NEEDLEMAN AND Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data: Sequence patterns motifs and profiles.

Module III 10 hours
Secondary Structure Predictions; prediction algorithms, Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Tertiary Structure predictions; prediction algorithms, Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Module IV 10 hours
Applications in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction; Fold recognition (threading), Protein structure predictions: Comparative Modeling (Homology, Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling & Dynamics, Drug Designing.
Books
1. Lesk. Introduction to Bio-informatics, OUP
2. Developing Bioinformatic Computer Skills, Cynthia Gibas and Per Jambeck, 2001 SPD.
3. Introduction to Bioinformatics, Atwood, Pearson Education
4. Beginning Perl for Bio-informatic, Tisdall, SPD

CPBT 8310 INSTRUMENTATION AND PROCESS CONTROL (3-0-0)

Module I

Introduction, Principles of measurement. Error Analysis, Static and dynamic characteristics of instruments.
Industrial Instruments for measurement

a) Temperature: Filled system Thermometer, Thermocouples, resistance thermometers, radiation and optical pyrometers.
b) Pressure: Manometers, elastic deformation and electrical type gauges, vacuum gauges-mechanical, electrical and ionization types.
c) Flow: Head flow meters, area flow meters, positive displacement flow meters, mass and magnetic flow meters.
d) Level: Direct and inferential type.

Module II

Miscellaneous measurement
Measurement of density and specific gravity, humidity, viscosity, viscosity and composition. Analytical principles involving emission spectrometry, IR spectroscopy, gas chromatography, X-ray and PH.

Process Instrumentation: Recording, indicating and signaling instruments, transmission of instrument readings, Instrumentation diagram.

Module III

Simple system analysis
Laplace transform, block digram, forcing function, concept of transfer function, Transient response of first, second and higher order system Linearization, Transportation lag, Lumped and distributed parameter system.
Feed back control: Control loop and its components, servov and regulator control, closed loop response.
Principle of automatic control with reference to proportional, integral and derivative modes.
MODULE IV  
10 hours

Controller tuning I) Zigler Nicols method ii) Process reaction curve
Control hardware Mesurement elements and dynamics, final control elements-sizing and dynamics. Pneumatic and electronoc controller. Elementary idea of feed forward, cascade, ratio , adaptive and digital computer control, control of complex processes such as distillation column and heat exchanger.

Text Books
1. Instrumentation, measurements and Analysis- B.C. Nakra & K. K. Chaudhury (TMH)
2. Process system analysis & Control- D. R. Coughanowr MGH.
3. Chemical Process Control – G. Stephanopoulus PHI.

Elective - II
PEBT 8303 MOLECULAR MODELING & DRUG DESIGN (3 - 0 - 0)

Module –I
EMPIRICAL FORCE FIELDS AND MOLECULAR MECHANISMS
Bond Stretching – Angle Bending- Torsional I terms- Out of plane- bonding motions- Electrostatic interactions- Van Der Waals interactions _ Effective pair potentials _ Hydrogen Bonding. Simulation of liquid water.

Module II
COMPUTER SIMULATION METHODS.
Calculation of thermodynamic properties – Phase space-Practical aspects of computer simulation – Boundaries monitoring Equilibrium - Long range process- Analysing results of simulation and estimating errors.

Module - III
MOLECULAR DYNAMICS SIMULATION METHODS
Molecular Dynamics using simple modules – Molecular Dynamics with continuous potentials- Running Molecular Dynamics simulation – Constant dynamics. Time dependent properties – Molecular Dynamics at constant temperature and pressure.

Module - IV
MONTE CARLO SIMULATION METHODS:
Metropolis methods: - Monte Carlo simulation of molecules- Monte Carlo simulation of polymers – Calculating chemical potentials – Monte Carlo simulation of Molecular Dynamics.

TEXT BOOKS

REFERENCE
PEBT 8304 BIOFERTILIZERS AND BIO-PESTICIDES (3 - 0 - 0)

Module I
Definition of Bio-fertilizers, Bacterial suspensions/inoculants as bio-fertilizers and bio-control agents to fight insect pests, weeds or diseases in plants; Atmospheric nitrogen fixing soil bacteria (Rhizobium, Azotobacter, Acetibacter) and several cyanobacteria;

Module II
Mechanism of soil bacteria and cyanobacteria for enhanced nitrogen fixation; Role of water fern Azola as biofertilizers; advantage of biofertilizers over chemical fertilizers; activity to control insect pests.

Module III
Free – living and symbiotic nitrogen fixers; nif genes to other soil micro-organism; Endophytic diazotrophs; NIF gene transfer; Nodulation by Rhizobium; Rhizobium management; Rhizo-sphere engineering.

Module IV
Biopesticide definition:
Types (Bioinsecticides and biofungicides); Protein antipest materials such as Bacillus Thuringiensis; Development of biopesticides, advantages over chemical pesticides (biodegradability, specificity).

References

PRACTICLS

CPBT 9304 DNA TECHNOLOGY LAB (0-0-3)

1) Isolation of genomic RNA
2) Isolation of plasmid
3) Agarose gel electrophoresis
4) Restriction Digestion DNA/plasmid
5) Isolation of RNA
6) Southern Blotting

CPBT 9305 PLANT TISSUE CULTURE LAB (0-0-2)

1) Explant selection sterilization and inoculation
2) Various media preparations: MS, B5, SHPCL2
3) Callus and cell suspension culture; induction and growth parameters
4) Chromosomal variability in callus culture
5) Plant regeneration from embryo, meristem and callus culture.
6) Androgenesis: Anther and pollen culture: Isolation and culture of protoplasts

CPBT 9306 BIO-INFORMATICS LAB (0-0-3)

1. DNA sequence analysis using BLAST: sequence pattern, motifs and profiles.
2. Prediction of secondary structure of proteins
3. Prediction of tertiary structure of (fold recognition, homology search)
4. Molecular modeling and dynamics: using small oligonucleotides and small protein with known crystal structure (available from data bank)
5. Drug designing-using available data

Applications of bioinformatics-open ended small project.
## COURSE STRUCTURE
### FOURTH YEAR B.TECH PROGRAMME
#### BIOTECHNOLOGY

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<td>Bioreactor Design and Analysis</td>
<td>3-1-0</td>
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<td>Animal Cell and Immune Tech.</td>
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Objective: This course introduces the students to the environmental consequences of Industries, development actions etc. and the methods of minimizing their impact through technology and legal systems.

Module – I


Chemistry and Microbiology in Environmental Engineering: Physical and chemical properties of water, Atmospheric chemistry, Soil chemistry, Microbiology, Chemical and biochemical reactions, Material balances and Reactor configurations.


Module – II

Water Pollution: water quality standards and parameters, Assessment of water quality, Aquatic pollution, Freshwater pollution, Estuarine water quality, Marine pollution, Organic content parameters, DO and BOD demand in streams, Transformation process in water bodies, Oxygen transfer by water bodies, Turbulent mixing, Water quality in lakes and preservers, Ground water quality.

Air Pollution: Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change – green house gases, non-criteria pollutants, emission standard form industrial sources, air pollution metereology, Atmospheric dispersion.


Module – III


Solid Waste Management 
Source classification and composition of MSW: properties and separation, storage and transportation, MSW Management, Waste minimization of MSW, Reuse and recycling, Biological treatment, Thermal treatment, Landfill, Integrated waste management.

Industrial Air Emission Control:
Characterization of air stream, Equipment selection, Equipment design, Special Methods: Flue gas desulphurization, NOx removal, Fugitive emissions.

Module – IV
(8 hours)

Environment impact Assessment, Origin and procedure of EIA, Project Screening for EIA, Scope studies, Preparation and review of EIS.

Reference
3. Environmental Science, Curringham & Saigo, TMH,
4. Principles of Environmental Science, Curringhum
5. Introduction to Environmental Science, Y. Anjaneyalu, B. S. Publication.

CPBT 8401 BIO-REACTOR DESIGN & ANALYSIS (3-1-0)

Module- I 10 hours

Module- II 10 hours
Reactor Design: Types of reactors – batch, plug low reactor (PFR), continuous stirred rank reactors (CSTR), fluidized bed reactor bubble column, air lift fermenter etc.

Module- III 10 hours
Analysis of Non-ideal Reactor Analysis: Concept of ideal and non-ideal reactor; residence time distribution; models of non-ideal reactors – plug flow reactor for microbial processes; Mass transfer in biochemical processes; Multiphase bioreactors – packed bed with immobilized enzymes or microbial cells; three – phase fluidized bed trickling bed reactor; Design and analysis of the above reactor systems; Gas liquid reactors, Reactor stability.

Module- IV 10 hours
Unconventional bioreactors: Hollow fiber reactor, membrane reactor, perfusion reactor for animal and plant cell culture.
Advanced Concepts:  Scale up concepts, Bioprocess control and computer coupled bioreactors; Growth and product formation by recombinant cells.

Books
1. Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern Ltd.

CPBT 8402 ANIMAL CELL AND IMMUNE TECHNOLOGY (3-1-0)

Module I          12 hours
History scope and prospect of animal cell culture
History of animal cell culture and development, Development of primary culture. Development of cell line by enzymatic disaggregation, Culture media and growth conditions.
Cell type and characterization, origin of animal cell line, maintenance and characterization of different cell lines, Market gene characterization.

Module II          10 hours
Growth and scale up
Cell growth characteristics and kinetics, Micro-carrier attached growth, Cell culture in continuous, perfusion and hollow fibre reactor, Mass transfer in mammalian cell culture.

Module III          10 hours
Technology – Present and future
Hybridoma technology, Organ culture technology, Transfection of animal cells, Future tissue engineering

Module IV          12 hours
Immune system
Defence and immunity, Immune response, Dysfunctions of immune system and their modulation, Approaches for correcting immune dysfunction, Vaccinology, Monoclonal antibody technology.

References
2. hood L.E., Weissman I., Wood W.B. and Wilson J.H. Immunology, Benjamin Cummings, 1989

Elective - III
PEBT 8401 BIOSENSORS AND DIAGNOSTICS (3-0-0)

Module I
Introduction – Immobilization key to biosensor construction, Biosensors diversification.

Module II
Redoxmediated systems, FET's (Field Effect Transistors), Thermistors, Conductimeters, Piezoelectric crystals, Optoelectric biosensors.

Module III
Variations on the biological/biochemical component, bioaffinity principles, whole cell biosensors.

Module IV
Applications and uses of biosensors, Clinical chemistry, medicine and health care, Veterinary, Agriculture and Food production, Environmental control and pollution monitoring.
Module I
Definition of biomaterials-biologically derived materials or materials compatible with biology.
Common biomaterials: some proteins, many carbohydrates and some specialized polymers.
Collagen(protein in bone and connective tissues): Structure production and its use.
Fibroin(protein in silk): Production a and its use.
Production of these proteins by conventional cloning methods.

Module II
Carbohydrates: Modified carbohydrates actin gas lubricants for biomedical applications; Polydextrose made from bacteria; Carbohydrates modified from enzymes; artificial wood.

Module III
Biopolymers: Synthesis from a simple biological monomer( eg hyaluronate polymers); Dextrans (used in chromatography columns); Rubberlike materials produced by bacteria and fungi (Polyhydroxybutyrate PHB), Polycaprolactone(PCL); Production of a polymer of PHB and PHV(polyhydrovaleric acid), sold as Biopol by fermentation on Alcaligenes eutrophus; Biodegradable polymers

Module IV
Industrial biopolymers: Production of polyphenol resins by the enzyme soybean peroxidase; Evaluation of the properties of biopolymers to make good biomaterials; Tensile strength(both elasticity and breaking strength); Hydration, visco – elastic properties; viscosity.

References:

Elective - IV
PEBT 8403 MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY (3-0-0)

Module 1 10 hours
Drug Development in Pharmaceutical Process
- Production of pharmaceuticals by genetically engineered cells(hormones, interferrons)
- Microbial transformation for production of important pharmaceuticals(steroids and semi-synthetic antibiotics)
- Techniques for development of new generation antibiotics
- Protein engineering, drug design, drug targeting

Module II 10 hours
Disease Diagnosis and Therapy
- ELISA and hybridoma technology
- DNA vaccine
- Gene Therapy
- Toxicogenomics

Module III 10 hours
Proteomics in Drug Development
- Role of Proteomics in Drug Development
- Diagnosis of disease by Proteomics
- Separation and identification techniques for protein analysis
- Development of antibody based protein assay for diagnosis

Module IV 10 hours

Diagnosis and Kit Development
- Use of enzymes in clinical diagnosis
- Use of biosensors for rapid clinical analysis
- Diagnostic kit development for microanalysis

References

PEBT 8404 HUMAN GENOMICS (PROTEOMICS AND PROTEIN ENGINEERING) (3-0-0)

Module 1 10 hours
- Patterns of genome organization
- Structural genomics
- Functional genomics
- Reverse genetics
- Gene patenting

Module II 10 hours
- Electronic PCR
- Genome mapping and genome sequencing
- Specialized database in molecular biology

Module III 10 hours
- Human genome project
- Human genome progress
- Genes in health and disease
- Genomic disorders and molecular medicine
- Minimal cell Genome

Module IV 10 hours
- Transfer of Genes to Humans
- Nucleic acids and Protein sequences database
- Pharmacogenomics
- Gene bank
- Legal status of gene bank

References:
Objective of the Course: The course aims at introducing the basic concepts of marketing to the undergraduate students in engineering. The learning shall help the students in better designing, manufacturing and selling product/service packages keeping competitive market, customers and cost in view.

Module – I

(9 hours)

Marketing Management: Concept, Process, Functions and relevance in the current context.
Competition Analysis: Factors contributing to competition, Competition analysis tools, Competitive arena mapping, Segmentation matrix.

Module II

(10 hours)

Market Research and Information Systems: Research Process, The Internet and World Wide Web based Information collection and processing, Database, Data Warehouses and Data Mining, Global Market Research, Competitive Intelligence.
Consumer Behaviour: Importance of buyer and his/her role in purchasing. Influence of buyer behaviour, Buyer behaviour study tools. Organizational buying behaviour.
Market Demand Forecasting: Key Terms, Forecasting Tools: Short term tools: Moving average and Exponential smoothing methods, Long-term forecasting Tools: Time series analysis, Econometrics methods, Qualitative tools: Buying Intention Survey, Sales Force Opinion and Delphi Techniques.

Module – III

(11 hours)


Module -IV

(10 hours)

Channels of Distributions: Designing Distribution Channels, Wholesaling and Physical Distribution, Retailing. Supply Chain Management (Basic only). Personal selling, Direct Marketing, Managing Sales Force.

References:

**CPBT 8403 FOOD BIOTECHNOLOGY (3-1-0)**

**Module I**

*Preservation technology*

Spoilage of food, Microbiology of water, meat, milk, vegetables, Technology – canning, dehydration, ultrafiltration, sterilization, irradiation etc.

**Module II**

*Food Production technology*

Single cell protein (yeast, mushroom, Fermentative production of food, Pickling and alcoholic beverages, Genetically manipulated crop.

**Module III**

*Technology for improved process*

Enzyme in bakery and cereal products, Enzymes in fat/oil industries, Protease in cheese making and beverage production, Utilization of food waste for production of valuables.

**Module IV**

*Food quality and control*

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

**References**

2. Frazier, Food Microbiology
3. G.Reed, Prescott and Dunn’s Microbiology, CBS publishers, 1987
4. Desrosier, Technology of food preservation, CBS publishers

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**CPBT 8404 ETHICS AND IPR IN BIOTECHNOLOGY (3-1-0)**

**Module I**

Juriprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR-like patent design and copying.

**Module II**

Distinction among the various forms of IPR, Requirement of a patentable invention like novelty, inventive step and prior art and state of art.

**Module III**

Rights/Protection, infringement or violation, Remedies against infringement, civil and criminal, Indian patent Act 1970 and TriPS, Major Changes in Indian patent system, Post TRIPS effects.

Contents of Patent specificaytion and procedure for patents

a) Obtaining patents

b) Geographical indication

c) WTO

Detailed information on patenting biologic products: biodiversity, Budapest treaty.

**Module III**

Release of genetically manipulated organism to the environment; genetic modifications and food uses; Ethical concerns relating to the food use of certain transgenic organism; genetic engineering of the animals (e.g.application of transgenic growth hormones into animals to improve meat quality) serve moral opposition.

**Module IV**
Areas of public concern on human genome research: genetic testing and screening; commercial exploitation of human genome; Eugenic pressures; effects of germslike

References
2) Santaniello, Evenson, Ziberman, Carison-Agriculture and Intellectual Property Rights, Univ. Press, 1998

Elective -V
PEBT 8405 PROTEIN ENGINEERING. (3-0-0)

Module I 10 hours
Design and construction of novel proteins and enzymes, confirmation of proteins in general and enzymes in particular.

Module II 10 hours
Effect of amino acids on structure of proteins, energy status of protein molecules, structure function relationship of enzymes.

Module III 10 hours
Physical methods such as X-ray crystallography, Laser roman Spectroscopy, mass spectrometry, circular dichromism and optical rotatory dispersion.

Module IV 10 hours
Site director mutagenesis for specific protein function, basic concepts of design of a new protein / enzyme molecule, specific example of enzym engineering.

References
1) H.D.Kumar, Molecular Biology, 2nd edition Vikas Publishing House Pvt Ltd.

PEBT 8406 PROTEOMICS (3-0-0)

Module I 10 hours
Introduction to proteomics and protein engineering
- Protein prefractionation and sample preparation
- Two dimensional electrophoresis (2-D PAGE)
- Protein identification
- Post translational modification

Module II 10 hours
Functional and Genomics
- Proteomics and drug delivery
- Reverse genetics
- Transcription and replication of negative strand viruses

Module III 10 hours
Protein engineering and transfer RNA world
- Essential requirements for protein synthesis
- Role of messenger RNA
- SNJRPS and introns
- Translation

Module IV 10 hours
Protein folding
- Hierarchical protein folding
- Defective protein folding
- Molecular chaperones
- The HSP 70 chaperone system
- Proteasomes, Prions, Polyketides and non-ribosomal peptides
- Combinational manipulation of polyketides and non-ribosomal peptides

References
4) H.D. Kumar, Molecular Biology, 2nd edition Vikas Publishing House Pvt Ltd.
6) Concepts in Biotechnology D. Balasubramaniam, Bryce, Dharmalingam, Green, Jayaraman
    Univ. press, 1996.

Elective - VI

PEBT 8407 MODELING AND SIMULATION OF BIOPROCESSES (3-0-0)

Module I
Approach to modeling, Unstructured and structured modeling, Deterministic and stochastic models,
Segregated and unsegregated models, Shu’s segregated models for Lactic acid fermentation.

Module II
Structured kinetic models: Compartmental models (two and three)
Product formation, Unstructured and structured models, Genetically structured models.

Module III
Stochastic model for thermal sterilization of the medium, Modeling for activated sludge process,
Model for anaerobic digestion, Models for lactic acid fermentation and antibiotic production.

Module IV
Process simulation techniques, Equation oriented approach, Equation oriented simulators(SPEED
UP, ASCEND, FLOWSIM, QUASILIN, DYNSIM), simulation programs based on Euler’s methods,
Newton-Raphsen methods, Runga-Kutta methods, Simulation of biochemical system models.

References
1) G. Francis, Modelling and Simulation
2) A. Haerder and J.A. Roels “Application of simple structured I Bioengineering, and P55 in
    Company

PEBT 8408 POLLUTION CONTROL, ENVIRONMENTAL BIOTECHNOLOGY &
    BIO-DIVERSITY (3-0-0)

Module I
Ecology & Biodiversity
10 hours
Introductory concepts, The biological world and Ecology: Ecological balance and consequences of
change, Biological word and eco-systems; Biochemical Diversity in ecosystem development; Diversity
indices; Cellular diversity and the classification of living system – Prokaryotic & Eukaryotic
organisms, General physical properties and Tolerance to environmental conditions; Microbial
Biodiversity – strategies – bio-prospecting and recovery.

Module II
Air Pollution Control Methods and Equipment
10 hours
Primary and secondary air pollutants, standards, sampling, basic ideas of air pollution control equipments, Bag Filter, Electrostatic Precipitators, cyclone separators, Wetscrubbers, Bio-scrubbers, Electrostatic precipitators, High volume sampler, RSPM Sampler, Control of specific gaseous pollutants.

**Module III**  
10 hours

**Wastewater Treatment by Biotechnological Processes**


**Module IV**  
10 hours

**Environmental Biotechnology : Specialized aspects**

Oil pollution – treatment with micro-organisms, Bioremediation-recovery of metals from waste water and sludge, xenobiotics, degradative capabilities of microorganisms with reference to toxicology, pesticides, herbicides, polyaromatic hydrocarbons, Anaerobic and aerobic composting, Vermiculture, Wetland Management, Membrane based waste water treatment processes – case studies.

**Books**

1. Odum, E.P.,*Fundamentals of Ecology*

**CPEE 9406 ENTREPRENEURSHIP PROJECT (0-0-3)**

1. The project will be for 2 credits and 3 periods per week is to be devoted for the project.
2. The teacher has to give elementary idea about entrepreneurship through classroom teaching before a project report is prepared by the student.
3. The teacher will first cover the following topics through lecturer and exercises on motivation and games.
   - Entrepreneurship concept, EDP in India, Indian middle class value.
   - Entrepreneurial qualities, motivation perception, risk taking etc.
   - Market survey, Business opportunity guidance
   - Role of DIC, SFC, Bank etc.
   - Decision making, Leadership, Communication skill
   - Preliminary Project Report, preparation for a specific product and submission of the report.
4. Evaluation
   (a) The teacher has to conduct tests/ motivational exercises to assess entrepreneurial capability of the student (20%)
   (b) The teacher has to test the knowledge of the student on the above topic through a written test. (20%)
   (c) The teacher has to evaluate the report submitted by the student (i.e. Project report within 50 pages) (60%).
Reference Books
1. Entrepreneurship of Small Industries, M. V. Deshpande, Deep and Deep Publication