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				4th Semester			
Theory		*Contact Hrs.*	*Credit*	*Theory*		*Contact Hrs.*	*Credit*
		L-T-P				**L-T-P**	
BSCM 2201	Mathematics - III	3-1-0	4	CPBT 7202	Cell Biology & Genetics	3-1-0	4
CPME 6208	Fluid Mechanics & Machines	3-1-0	4	CPBT 7203	Microbiology	3-1-0	4
BSCP 2201	Physics - II /	3-0-0	3	BSCC 2201	Chemistry - II /	3-0-0	3
BSCP 2202	Physics of Semi-Conductor Devices			BSCC 2202	Material Sciences		
	or				or		
BSCC 2201	Chemistry - II /			BSCP 2201	Physics - II /		
BSCC 2202	Material Sciences			BSCP 2202	Physics of Semi-Conductor Devices		
BCSE 3201	Object Oriented Programming	3-0-0	3	BCSE 3202	Relational Database Management System	3-0-0	3
HSSM 4201	Engineering Economics & Costing	3-0-0	3	HSSM 4202	Organisational Behaviour	3-0-0	3
	or				or		
HSSM 4202	Organisational Behaviour			HSSM 4201	Engineering Economics & Costing		
CPBT 7201	Biochemistry	3-1-0	4	CPBT 7204.	Molecular Biology	3-1-0	4
	Total		**20**		**Total**		**20**
Practicals/Sessionals		*Contact Hrs.*	*Credit*	*Practicals/Sessionals*		*Contact Hrs.*	*Credit*
BENG 9202	Basic Electronics Laboratory	0-0-3	2	BENG 9201	Basic Electrical Engineering Laboratory	0-0-3	2
	or				or		
BENG 9201	Basic Electrical Engineering Laboratory			BENG 9202	Basic Electronics Laboratory		
BCSE 9201	OOPs Computer Lab	0-0-3	2	BCSE 9202	RDBMS Lab	0-0-3	2
BENG 9203	Mechanical Engineering Laboratory	0-0-3	2	CPBT 9202	Microbiology Lab	0-0-3	2
CPBT 9201	Biochemistry Lab.	0-0-3	2	CPBT 9203	Cell & Molecular Biology Laboratory	0-0-3	2
			8				**8**
	Total		**28**		**Total**		**28**

L-Lecture **T-Tutorial** **P-Practical**

3rd Semester

BSCM 2201 MATHEMATICS - III (3-1-0)

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 (12 hours)

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 (12 hours)

Buoyancy and flotation, Archimedes' principle, stability of immersed and floting bodies, determination of metacentric height.

Fluid kinematics : Introduction, description of fluid flow, classification of fluid flow. Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity.

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 (6 hours)

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 (8 hours)

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

Tex Books

1. Fluid Mechanics, A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som and G. Biswas, TMH
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.
2. D.C. Accelerators : Cockcroft - Walton, Van de Graff, Tandem accelerators.
3. RF accelerators : Linear accelerator, cyclotron, electron accelerator, betatron.
4. Application of nuclear accelerators - production of radioisotopes, radiation processing of materials, medical applications.

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.

1. Energy bands in solids: Kronig - Penny model, allowed bands and forbidden gaps, elemental and compound semiconductors.
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.

Laser : Principle of lasing, properties of Laser, construction and working of semiconductor laser, Application of laser.

LED : Principle construction of operation and application, Introduction to fibre optics, basic characterstics 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
6. Physics - II, B. B. Swain and P. K. Jena.

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; Do pant 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

Basic Principle of Operation., Simplified Transistor Current Relation. Modes of operation, Amplification with Bipolar transistors, Minority Carrier distribution Forward active mode, other modes of operation. Low Frequency Common Base Current gain,. Non-ideal effects –Base width Modulation, Breakdown Voltage. Equivalent Circuit Models –Eber's –Moll Model, Hybrid- Pi model. Frequency limitation. Large Signal Switching characteristics.

Text Book :

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

For additional reading

2. Solid state Electronics Devices – y Ben G. Strectman and Sanjay Benerjee, 5th Edition, Pearson Edu.

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

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 Corrotion, Factors affecting corrosion, Corrosion Control : (Proper design and fabrication procedure, Cathodic protection, Passivation).

   (8 Lectures)

2. Polymers:

   Nomenclature and classification, Thermoplastic and thermosetting resins, Some typical useful polymers:Polyethylene,PVC, polystyrene, PMMA, Nylon 6:6, Nylon 6, Bakelite, Terylene, Silicones. Natural and synthetic rubbers: Neoprene, Butyl and Polyuarethane rubber, Vulcanization.

   (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 : Prodcer gas, Water gas, LPG & CNG.

   Cobustion 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:

1. Organic Chemistry by Morrison and Boyd, 5th/6th Ed., Prentice Hall.
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
5. Inorganic Chemistry by D. F. Shriver, P. W. Atkins, C. H. Langaford ,Oxford, 1990
6. A Text Book on Engineering Chemistry by B. Pani, Galgotia Publication.
7. Engineering Chemistry by P. C. Jain and M. Jain.
8. Engineering Chemistry by R. Gopalan, D. Venkapaya and S. Nagarajan, Vikas Publishing House.

BSCC 2202 MATERIAL SCIENCES (3-0-0)

MODULE - I (10 Lectures)

1. Classification of Engineering Materials. Engineering properties of materials. Internal structure and properties.
2. Electron theory of solids : Free electron theory of metals. Electrical conductivity; Thermal conductivity, Quantum theory of free electrons. Band theory of solids, Conductivity of metals
3. Conductors, Insulators, Semiconductors, Intrinsic and extrinsic semiconductors, Band theory of semi conductors Hall effect.

MODULE - II (10 Lectures)

4. Super Conductors - Zero resistivity, Critical magnetic field and critical current density. Type I and II super conductors. Applications of Supercoductors.
5. Dielectric Materials : Microscopic Displacement of atoms and molecules in an external dc electric field, Polarization and dielectric constant, Dielectric susceptibiity. Temperature dependence, Dielectric Breakdown. Ferro electric material Piezoelectrics, Pyroelectrics, Dielectric Materials as electrical isulators.
6. Magentic Properties of Materials : Dia, Para and Ferro magenetic materials. Theory of magnetism, Ferro magnetic materials or Ferrites, Comparison of magnetic behaviour and magnetic parameters of Dia, Para and Ferro magnetic materials.

MODULE - III (8 Lectures)

7. Optical Properties of Materials : Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres - Principle, structure, application of optical fibre.
8. Organic Materials : Polymers - Mechanism of Polymerization : Addition, condensation and co-polymerisation, applications.

   Plastics - Types : Thermosetting and thermoplastics.

MODULE - IV (8 Lectures)

9. Composite Materials : Agglomerated Materials : Cermets, Reinforced Materials : Reinforced Concrete. Glass fibre reinforced plastics, Carbon fibre reinforced plastics. Whiskers, fibre reinforced plastics, Laminated plastic sheets. Tufnol, Properties of composites.
10. Ceramics : Types, Structure, Mechanical properties, applications
11. Performance of Materials in Service : Service performance, failure, design considerations, Corrosion - types, (Atmospheric, Pitting, Stress Corrosion), Control & prevention, protective coating, Performance of metals and Ceramics at high temperature.

Text Books :

1. Callister W.D., Materials Science and Engineering, John Wiley & Sons.
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 handing: 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
2. Ashok N. Kamthane- Object oriented Programming with ANSI & Turbo 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 infite 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)

Fixed and variable cost, Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction techniques.

Text Book

1. Horn green, C.T., Cost Accounting, Prentice Hall of India
2. Riggs, J.L ., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGraw Hill International Edition, 1996 (Chapter 2,3,4,5,7,8,9,11,12)

HSSM 4202 ORGANIZATIONAL BEHAVIOUR (3-0-0)

Module I (8 Hours)

The Study of Organizational Behaviour : Learning objectives, Definition and Meaning, Why Study OB, An OB Model, New Challenges for OB Manager.
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.
Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Hertzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.
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

Organizations - Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership – Leadership & Management, Theories of Leadership – Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Follwership, How to be an effective Leader. Conflict – Nature of Conflict and Conflict Resolution.
An Introduction to Transactional Analysis (TA).
Case Analysis

Module IV (10 Hours)

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management – Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organizational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.
Case Analysis

TEXTBOOKS:

Keith Davis, Organizational Behaviour, McGraw – Hill.
K.Aswathappa, Organizational Behaviour, Himalaya Publishing House.

REFERENCE BOOKS:

Stephen P. Robbins, Organizational Behaviour, Prentice Hall of India.
Pradip N. Khandwalla, Organizational Behaviour, McGraw – Hill, New Delhi.

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 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.
3. V - I Characterstic of a semiconductor diode. Determining DC and AC resistance.
4. Half wave and Full wave rectifiers without and with capacitor filter. Record of waveforms, Measurement of Average and rms values.
5. V - I Characterstics of anpn or pnp transistor. DC Biasing and measurement of dc voltages and currents.
6. Gain - frequency response of JFET common source R-C coupled amplifier/BJT CE RC coupled Amplifier.
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.

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.
9. Starting and speed control of a DC shunt motor.
10. Connection and testing of a single phase energy meter (unity power factor load only)
11. Study of fan motor

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)
8. Design problem on stock and accounting of a small organization, railway reservation, payroll preparation and optimization problem.(3 classes)

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
3. Determination of tensile strength of materials by Universal Testing Machine.

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.
6. Determination of Cd and Cd of Orifices.

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.
9. Study of Cut-Sections of 2 stroke and 4 stroke Petrol 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

4th Semester

CPBT 7202 CELL BIOLOGY AND GENETICS (3-1-0)

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 obsolesion. 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 in-heritance (Mandelian Principles) gene interaction, alleles, complementation, linkage, re-combination 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
2. Principle of Bio-Chemistry – Lehninger, Nelson and Cox
3. The Cell a molecular approach, Geoffrey M. Cooper, ASM press Washington D.C. Sinauer Associates, Inc.
4. Molecular Biology of Cell – Alberts, Garland Science, Taylor & Francis Group.
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
10. Biochemistry – Voet & Voet, John Wiley & Sons, INC, Network, Toronto Singapore.

CPBT 7203 MICROBIOLOGY (3-1-0)

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, hetertrophs, 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.

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 Corrotion, Factors affecting corrosion, Corrosion Control : (Proper design and fabrication procedure, Cathodic protection, Passivation).

   (8 Lectures)

2. Polymers:

   Nomenclature and classification, Thermoplastic and thermosetting resins, Some typical useful polymers:Polyethylene,PVC, polystyrene, PMMA, Nylon 6:6, Nylon 6, Bakelite, Terylene, Silicones. Natural and synthetic rubbers: Neoprene, Butyl and Polyuarethane rubber, Vulcanization.

   (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 : Prodcer gas, Water gas, LPG & CNG.

Cobustion 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:

1. Organic Chemistry by Morrison and Boyd, 5th/6th Ed., Prentice Hall.
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
5. Inorganic Chemistry by D. F. Shriver, P. W. Atkins, C. H. Langaford ,Oxford, 1990
6. A Text Book on Engineering Chemistry by B. Pani, Galgotia Publication.
7. Engineering Chemistry by P. C. Jain and M. Jain.
8. Engineering Chemistry by R. Gopalan, D. Venkapaya and S. Nagarajan, Vikas Publishing House.

BSCC 2202 MATERIAL SCIENCES (3-0-0)

MODULE - I (10 Lectures)

1. Classification of Engineering Materials. Engineering properties of materials. Internal structure and properties.
2. Electron theory of solids : Free electron theory of metals. Electrical conductivity; Thermal conductivity, Quantum theory of free electrons. Band theory of solids, Conductivity of metals
3. Conductors, Insulators, Semiconductors, Intrinsic and extrinsic semiconductors, Band theory of semi conductors Hall effect.

MODULE - II (10 Lectures)

4. Super Conductors - Zero resistivity, Critical magnetic field and critical current density. Type I and II super conductors. Applications of Supercoductors.
5. Dielectric Materials : Microscopic Displacement of atoms and molecules in an external dc electric field, Polarization and dielectric constant, Dielectric susceptibiity. Temperature dependence, Dielectric Breakdown. Ferro electric material Piezoelectrics, Pyroelectrics, Dielectric Materials as electrical isulators.

6. Magentic Properties of Materials : Dia, Para and Ferro magenetic materials. Theory of magnetism, Ferro magnetic materials or Ferrites, Comparison of magnetic behaviour and magnetic parameters of Dia, Para and Ferro magnetic materials.

MODULE - III (8 Lectures)

7. Optical Properties of Materials : Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres - Principle, structure, application of optical fibre.
8. Organic Materials : Polymers - Mechanism of Polymerization : Addition, condensation and co-polymerisation, applications.

   Plastics - Types : Thermosetting and thermoplastics.

MODULE - IV (8 Lectures)

9. Composite Materials : Agglomerated Materials : Cermets, Reinforced Materials : Reinforced Concrete. Glass fibre reinforced plastics, Carbon fibre reinforced plastics. Whiskers, fibre reinforced plastics, Laminated plastic sheets. Tufnol, Properties of composites.
10. Ceramics : Types, Structure, Mechanical properties, applications
11. Performance of Materials in Service : Service performance, failure, design considerations, Corrosion - types, (Atmospheric, Pitting, Stress Corrosion), Control & prevention, protective coating, Performance of metals and Ceramics at high temperature.

Text Books :

1. Callister W.D., Materials Science and Engineering, John Wiley & Sons.
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.
2. D.C. Accelerators : Cockcroft - Walton, Van de Graff, Tandem accelerators.
3. RF accelerators : Linear accelerator, cyclotron, electron accelerator, betatron.
4. Application of nuclear accelerators - production of radioisotopes, radiation processing of materials, medical applications.

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.

1. Energy bands in solids: Kronig - Penny model, allowed bands and forbidden gaps, elemental and compound semiconductors.
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.
Laser : Principle of lasing, properties of Laser, construction and working of semiconductor laser, Application of laser.
LED : Principle construction of operation and application, Introduction to fibre optics, basic characterstics 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
6. Physics - II, B. B. Swain and P. K. Jena.

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; Do pant 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

Basic Principle of Operation., Simplified Transistor Current Relation. Modes of operation, Amplification with Bipolar transistors, Minority Carrier distribution Forward active mode, other modes of operation. Low Frequency Common Base Current gain,. Non-ideal effects –Base width Modulation, Breakdown Voltage. Equivalent Circuit Models –Eber's –Moll Model, Hybrid- Pi model. Frequency limitation. Large Signal Switching characteristics.

Text Book :

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

For additional reading

2. Solid state Electronics Devices – y Ben G. Strectman and Sanjay Benerjee, 5th Edition, Pearson Edu.

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)

Storage Strategies: Indices, B-Trees, Hashing, Transaction processing: Recovery and Concurrency Control, Locking and Timestamp based Schedulers, Multiversion and Optimistic Concurrency Control Schemes.

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

Text Books:-

1. Elmaski & Navathe -Fundamentals of Database Systems, 4th Edition, Pearson Education
2. C.J.Date - An introduction to Database Systems, Pearson Education
3. Bipin Desai -An introduction to Database System, Galgotia Publication.

HSSM 4202 ORGANIZATIONAL BEHAVIOUR (3-0-0)

Module I (8 Hours)

The Study of Organizational Behaviour : Learning objectives, Definition and Meaning, Why Study OB, An OB Model, New Challenges for OB Manager.

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.

Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Hertzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

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 Organizations - Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership – Leadership & Management, Theories of Leadership – Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Follwership, How to be an effective Leader. Conflict – Nature of Conflict and Conflict Resolution.

An Introduction to Transactional Analysis (TA).

Case Analysis

Module IV (10 Hours)

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management – Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organizational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

Case Analysis

TEXTBOOKS:

Keith Davis, Organizational Behaviour, McGraw – Hill.
K.Aswathappa, Organizational Behaviour, Himalaya Publishing House.

REFERENCE BOOKS:

Stephen P. Robbins, Organizational Behaviour, Prentice Hall of India.
Pradip N. Khandwalla, Organizational Behaviour, McGraw – Hill, New Delhi.

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 infite 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)

Fixed and variable cost, Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction techniques.

Text Book

1. Horn green, C.T., Cost Accounting, Prentice Hall of India
2. Riggs, J.L ., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGraw Hill International Edition, 1996 (Chapter 2,3,4,5,7,8,9,11,12)

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 ukaryotes, enzymes involved in DNA replication nucleotide sequence composition, Unique, middle and highly repeative 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 prokoryote 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, nomencleature and sequence recognitions, DNA modification enzymes, ligase, (both quantitative and qualitative aspects), cloning – Vectors, plasmids, bacteriophase, 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 :

1. Text Book of mol. Biol. By Padmanabhan and Shastri.
2. Mol. Biology. by Turner.
3. Mol. "Biology of Gene" – Watson
4. Principles of Mol. Biology - OS Prim Rose
5. Recombinant DNA Technology – Watson
6. Mol. Cell Biology. - Baltimore

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.
9. Starting and speed control of a DC shunt motor.
10. Connection and testing of a single phase energy meter (unity power factor load only)
11. Study of fan motor

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 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.
3. V - I Characterstic of a semiconductor diode. Determining DC and AC resistance.
4. Half wave and Full wave rectifiers without and with capacitor filter. Record of waveforms, Measurement of Average and rms values.
5. V - I Characterstics of anpn or pnp transistor. DC Biasing and measurement of dc voltages and currents.

6. Gain - frequency response of JFET common source R-C coupled amplifier/BJT CE RC coupled Amplifier.
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.

2-4 Isolation of microorganism from natural habitat (air, water, soil, spoiled fruits and vegetable).

5. Isolation and pure culture by dilution plating and streaking.
6. Study of compound and phase –contrast microscope.

7-8 Simple staining, Gram Staining, Endospore staining, fungal staining.

9-10 Study of bacterial / yeast growth by spectrophotometer and viability studies.

11 Study of biochemical activity of microorganism starch hydrolysis, casein, hydrolysis, IMVIC text.

12. Sterilization of antibiotics by filtration and assay by zone inhabitation.
13. MIC determination of antibiotics.
14. Chemical assay of penicillin.

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

1-3 Spectroscopic analysis of protein, DNA, RNA (Visible and UV)

4. Isolation of plasmid DNA and analysis by gel electrophoresis.
5. Transformation using plasmid DNA.

6-8 Isolation of genomic DNA – Bacteria, plant animal, quantitation and analysis by agarose gel electrophoresis.

9-11 Isolation of auxotrophic mutant –spontaneous and induced using (a) UV (b) chemical mutagen.

12 Restriction digestion and analysis using agarose gel electrophoresis.

COURSE STRUCTURE
THIRD YEAR B.TECH PROGRAMME
BIOTECHNOLOGY

5th Semester

Theory		*Contact Hrs.* L-T-P	*Credit*
CPBT 8301	Unit Operation - I Up Stream Processing	3-1-0	4
CPBT 8302	Industrial Microbiology & Enzyme Technology	3-1-0	4
CPBT 8303	Structural Biology	3-0-0	3
CPBT 8304	Immunology	3-0-0	3
CPBT 8305	Biochemical Reaction Engg.	3-1-0	4
	Elective I (any one)	3-0-0	3
PEBT 8301	Renewable Energy Technology		
PEBT 8302	Biometallurgy		
	Total		**21**

Practicals/Sessionals		*Contact Hrs.*	*Credit*
CPBT 9301	Molecular Biology & Fermentation Tec. Lab	0-0-3	2
CPBT 9302	Immunology Lab	0-0-3	2
CPBT 9303	Unit Operation-I Lab	0-0-3	2
			6
	Total		**27**

6th Semester

Theory		*Contact Hrs.* L-T-P	*Credit*
CPBT 8306	Unit Operation -II & Downstream Processing	3-1-0	4
CPBT 8307	DNA Technology	3-1-0	4
CPBT 8308	Plant Biotechnology	3-1-0	4
CPBT 8309	Bioinformatics	3-0-0	3
CPBT 8310	Instrumentation and Process Ctrl.	3-0-0	3
	Elective II (Any one)	3-0-0	3
PEBT 8303	Molecular Modeling & Drug Design		
PEBT 8304	Biofertilizer & Biopesticide		
	Total		**21**

Practicals/Sessionals		*Contact Hrs.*	*Credit*
CPBT 9304	DNA Technology Lab	0-0-3	2
CPBT 9305	Plant Tissue Culture Lab.	0-0-2	2
CPBT 9306	Bioinformatics Lab	0-0-3	2
			6
	Total		**27**

L-Lecture **T-Tutorial** **P-Practical**

5th Semester

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

Module I **10 hours**

Basic concepts of Fluid Mechanics : Dimensional Analysis : Buckingham Pi-theorem, Dimensionless groups, Conversion of equations. Basic equations of Fluid Flow, Hagen poiseville equation, Bernoulli Equation, Fluid Friction. Friction in flow through packed beds, fundamentals of fluidisation.

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**

Heat transfer : Classification of heat flow processes, conduction, Thermal conductivity. Heat flow in fluids by conduction and convection. Countercurrent and parallel flow. Enthalpy balance in heat exchange equipment. Individual heat transfer coefficients, overall coefficient, Heating and cooling of fluids, Heat transfer equipment. Unsteady state heat transfer, Radiation.

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, Filteration, Principle, Constant pressure and constant rate filtration, Settling classifiers, Floatation, Centrifugal Separations.

Books :

1. Unit Operations of Chemical Engineering : McCabe, Smith & Harriot, TMH, 5th edition.
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
6. Foust, A.S.,Wenzel, L.A, et.al.Principles of Unit Operations, 2nd edition, JWS
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, isomarization and rearrengement, C-C bond cleavage and fermentation.

Module III **10 hours**

Stability of enzyme: Enzyme stabilization by selection and genetic engineering, protein engineering. Application of enzymes in industry, analytical purpose and medical therapy.

Module IV **10 hours**

Reaction environment: Reaction environment rebuilding, chemical modification, intramolecular cross linking and immobilization.

Books

1. Industrial Microbilogy, Prescot and Dunn,
2. Biochemical Engineering and Biotechnology Handbook, Atkinson, B and Marituna, F., The Nature Press, Macmillan Publ. Ltd.
3. Biochemical Engineering Fundamentals, Bailey & Olis. MGH.

CPBT 8303 STRUCTURAL BIOLOGY (3-0-0)

Module I

Macromolecules and supramolcular 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

1. Immunology: Lydyard, P.M., Whelan, A., Fanger, M.W., 1ST Ed ., Viva Books.
2. Essential Immunology: Roitt, I.M., 9TH Ed.(1997) Blackwell Scientific, Oxford, UK.

3. Immunology: Kuby, J. 3RD Ed.(1997) Freeman W. H., oxford.

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:

The ideal Gas, Review of first and second laws of thermodynamics, PVT behaviour of Pure Substances, Virial Equation of State, Application of the Virial Equations, Cubic Equations of State, Generalized Correlations for Gases and Liquids.

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

The Nature of Equilibrium, the Phase Rule, Duhem's Theorem, Simple model's for Vapour/Liquid Equilibrium, Roult's Law, Henry's law, Modified Raoult's Law, K-value Correlations, VLE from Cubic Equations of State, Equilibrium and Stability, Liquid/Liquid Equilibrium, Solid/Liquid Equilibrium, Solid/Vapour Equilibrium.

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

1. Chemical process Principles (Part one and two), Houge, Watson & Ragatz, Asian Student Edition, Asia Publishing House.
2. Basic Principles and Calculations in Chemical Engineering, Himmelbalu, Prentice Hall (l) 6th Ed.
3. Coulson & Richardson's Chemical Engineering- Volum 3 (Chemica l and Biochemica Reactors and process controls) ed. Ricchardson. J.F., Peacock. D.G.,First Indian ed. Asian Books Pvt.Ltd. 1998.
4. Levenspiel, O., Chemical Reaction Engineering,Wiley Eastern Ltd.
5. Smith & Vanness, Thermodynamics for Chemical Engineers, MGH.
6. Bailey & Oils, Biochemical Engg. Fundamentals, MGH, 1990

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

Solar energy: solar collectors, solar pond, photovoltaic cells, chemical storage. Geothermal energy and wind energy: Use of geothermal energy, operating principles of different types of wind energy mills. Nuclear energy: nuclear reactions and power generating tidal wave energy.

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

1. H.D.Kumar and S. Kumar, Modern concepts of Microbiology, Vikas Publishing House, 2nd Edition, 2001.

2. M.E.Curtain, Microbial mining and metal recovery biotechnology(1), pp 229-235, 1983.

3. Woods D, Rawling D.E., Bacterial bleaching and biomining in marx J.L.(ed.), Revolution of Biotechnology, Cambridge University Press.

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 strirrer 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 onflow 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.

6th Semester

CPBT 8306 UNIT OPERATION II AND DOWN STREAM PROCESSING (3-1-0)

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, Electophoresis SDS-PAGE (Polyacrylamide Gel), horizontal and vertical type, methods, case studies.

Module IV

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

Books

1. Schuler & Kargi: Bio process Engg. PHI
2. Keith Wilson and John Walker, Practical Biochemistry- Principles and Techniques, Cambridge, 5th Ed. 2000.
3. Coulson & Richardson's Chemical Engineering-Volume 3(Chemical and Biochemical Reactors and Process Controls) ed. Richardson, J.F., Peacock , D.G., First Indian ed. Asian books pvt.ltd. 1988.
4. Bailey & Oils: Biochemical Engg. Fundamentals, Mc-Graw –Hill., 1990.
5. Geankoplis, C.J.: transport processes and unit operations prentice Hall of (I) 3rd edition .1997.
6. Mukhopadhyay, S.N. process Biotechnology Fundamentals, Viva books Pvt. Ltd. 2001.
7. Muni & Cheryan, Handbook of Ultrafiltration.
8. Unit operations of chemical Engineering: McCabe, Smith & Harriot, TMH, 5TH edition.

References:

1. Perry, Chilton & Green, Chemical engineers' Handbook, MGH.
2. Ho, W.S.W. and K.K.Sirkar, Membrane Handbook, Van Nostrand Reinhold, N.Y.(1992).

CPBT 8307 DNA TECHNOLOGY (3-1-0)

Module I **10 hours**

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 translational 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 blotting in situ, DNA fingerprinting.

Module III **10 hours**

Gene transfer technology

CDNA and genomic DNA library, gene isolation and cloning, polymerase chain reaction and site directed mutagenesis. Expression of cloned gene in recombinant cells, - stability of recomibinant cels – production of biochemicals - discu;ssion with examples.

Module IV **10 hours**

Application of rDNA technology

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

References

1. D.M.Glover, Genetic engineering, cloning DNA, Chapman and Hall, New york, 1980
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.

—Agarobacterium, Ti plasmid vector

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

Plant engineering towards development of enriched food products,

Plant growth regulators.

References

1. Slater, Plant Biotechnology, OUP
2. H.E.Street (ed): Tissue culture and plant science, Academic press, London, 1974.
3. M.K.Sateesh, Biotechnology-5 Animal cell biotechnology , Immune biotechnology, Plant biotechnology . New Age Int Publishers, 2003.
4. Concepts in Biotechnology, D.Balasubramaniam, Bryce, Dharmalingam, Green, Jayaraman Univ. press, 1996.

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
5. Biocomputing: Informatics and Genome Project, Smith, D.W. 1994, Academic press, NY.
6. Bioinformatcs: A practical guide to the analysis of Genes and Proteins, Baxevanis, A.D. Quellette, B.F.F., John Wiely &Sons.

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

Module I **10 hours**

Introduction, Principles of measurement. Error Analysis, Static and dynamic characterstics of instruments.

Industrial Instruments for measurement

a) Temperature: Filled system Thermometer, Thermoccupies, 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 metrs, area flow meters, positive displacment flow meters, mass and magnetic flow meters.
d) Level: Direct and inferential type.

Module II **10 hours**

Miscellaneous measurement

Measurement of density and specific gravity, humidity, viscocity, 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 II **10 hours**

Miscellaneous measurement.

Measurement of density and specific gravity, humidity, viscosity and composition. Analytical priniciples involving emission spectrometry, I R , spectroscopy, gas chromatography, polarography, x-ray and Ph.

Prpcess instrumentation Recording, Indicating and signaling instruments, Transmission of instrument reading, Instrumention diagram.

Module III **10 hours**

Simple system analysis

Laplace transform, block digagram, 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, serov and regulator control, closed loop response.

Principle of automatic control with reference to proportional, integral and derivative modes.

MODULE IV **10 hours**

Stability Concept : Routh –Hertwitz method, root locus method and Bodediagrams.

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 controleler. 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

1) A.R. Leach, Molecular Modelling Principle and Applications, Longman, 1996.
2) J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John. Wiley and Sons, 1997.

REFERENCE

1) GROMOS 95 Manual, BIOMOS Switzerland 1995.
2) HYPERCHEM Manual hypercube Canada 1995.

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

Module I

Definition of Bio-fertilizers, Bacterial suspensions/inoculants as bio-fertillizers and bio-control agents to fight insect pests, weeds or diseases in plants; Atmosheric 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

1. Stacey, Burris and Evans(ed), Biological Nitrogen Fixation, Chapman & Hall, 1992.

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) Southrn 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; inductionand 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 oligonucleofides and small protein with known crystal structure(available from data bank)
5. Drug designing-using available data

Applications of bio informatics-open ended small project.

COURSE STRUCTURE
FOURTH YEAR B.TECH PROGRAMME
BIOTECHNOLOGY

7th Semester				8th Semester			
Theory		*Contact Hrs.*	*Credit*	*Theory*		*Contact Hrs.*	*Credit*
		L-T-P				**L-T-P**	
HSSM 4403	Environmental Engineering.	3-0-0	3	HSSM 4404	Marketing Management	3-0-0	3
CPBT 8401	Bioreactor Design and Analysis	3-1-0	4	CPBT 8403	Food Biotechnology	3-1-0	4
CPBT 8402	Animal Cell and Immune Tech.	3-1-0	4	CPBT 8404	Ethics & IPR in Biotechnology	3-1-0	4
	Elective III (Any one)	3-0-0	3		**Elective V (any one)**	3-0-0	3
PEBT 8401	Biosensors & Diagnostics			PEBT 8405	Protein Engineering		
PEBT 8402	Biometerial			PEBT 8406	Proteomics		
	Elective IV (Any one)	3-0-0	3		**Elective VI (any one)**	3-0-0	3
PEBT 8403	Medical & Pharmaceutical Biotech.			PEBT 8407	Modeling & Simulation of Bioprocesses		
PEBT 8404	Human Genomics (Proteomic & Protein Engg.)			PEBT 8408	Pollution Control, Environmental Biotech & Biodiversity		
	Total		**17**		**Total**		**17**
Practicals/Sessionals		*Contact Hrs*	*Credit*	*Practicals/Sessionals*		*Contact Hrs.*	*Credit*
CPBT9401	Project	0-0-3	2	CPBT 9403	Project		7
CPBT 9402	Seminar	0-0-2	1	CPBT 9404	Seminar	0-0-2	1
			3	CPBT 9405	Entrepreneurship Project	0-0-3	2
					Comp. Viva Voce	0-0-3	2
	Total		**20**				**12**
					Total		**29**

L-Lecture **T-Tutorial** **P-Practical**

7th Semester

HSSM 4403 ENVIRONMENTAL ENGINEERING (3-0-0)

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

Ecological Concepts and Natural Resources : Ecological perspective and value of environment. Environmental auditing, Biotic components, Ecosystem Process : Energy, Food Chain, Water cycle, Air cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law, Global Perspective.

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.

Concept in Hydrology : Hydrological cycle, Water balance, Energy budget, Precipitation, Infiltration, evaporation and evapotranspiration, Rainfall-runoff relationships, Urban hydrology, Ground water, Ground water chemistry, Water contamination and pollution prevention.

Module – II

(9 hours)

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.

Noise Pollution : Physical Properties of sound, Noise criteria, Noise Standards, Noise measurement, Noise control.

Module – III

(15 hours)

Water Treatment : Water quality standards, Water sources and their quality, Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Waste Water Treatment : Water flow rate and characteristics, Design of waste water network, Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment : Anaerobic digestion and its microbiology, Reactor configurations and methane production. Application of anaerobic digestion. Bio-solids regulations, Characteristics and processing of bio-solids, first and second stage processing of sludge. Sludge disposal,. Integrated sewage and sludge management.

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.

Hazardous Waste Management, Hazardous waste and their generation, Medical hazardous waste, Household waste, Transportation and treatment of hazardous waste : Incinerators, Inorganic waste treatment, Treatment systems for hazardous waste, handling of treatment plant residue.

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)

Waste Minimization : Concept, Life Cycle Assessment, Elements of waste minimization strategy, Benefits of waste minimization, Elements of waste minimization programme, Waste reduction techniques.

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

Reference

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
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**

Basic Principles: Recapitulation of the principles of Kinetics for chemical and Bio-chemical Reactions. Fundamentals of homogeneous reactions for batch, plug flow, semi-batch, stirred tank/mixed reactors., adiabatic and programmed reactors.

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 fuidized 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, membrance 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.
2. Bailey & Olis, Biochemical Engg. Fudamentals, MGH.,1990
3. Atkinson, B.,Biological Reactors, pion Ltd., London,1974.

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

1. Balasubramanian, Bryce, Dharmalingam, Green and Jayaraman (Eds.),Concepts in Biotechnology, University Press, 1996.
2. hood L.E., Weissman I., Wood W.B. and Wilson J.H. Immunology, Benjamin Cummings, 1989
4. Biotol Series – Butterworth and heineman, Oxford, 1992

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 heatlth care, Veterinary, Agriculture and Food production, Environmental control and pollution monitoring.

References:

1) Turner, A.P.F., Karube.I.,and Wilson, G.S. Biosensors Fundamentals and applications, Oxford Univ.Press.

2) D.Thomas and J.M. Laval-Enzyme Technology in concepts in Biotechnology by Balasubramaniam et al, Univ. press, 1996.

PEBT 8402 BIOMATERIALS (3-0-0)

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); Rubberllike 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:

1. Ratiedge C and Kristiansen B, Basic Biotechnology, Cambridge University Press, 2nd Edition, 2001

2. Doi y, Microbial Polyesters, VCH Weinheim, 1990.

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

Module 1 **10 hours**

Drug Development in Pharmaceutical Process

- Production of pharmaceuticals by genertically 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

1. Balasubramanian, Bryce, Dharmalingam, Green and Jayaraman(ed), Concepts in Biotechnology, University Press, 1996
2. Epenetos A.A.(ed),Monoclonal antibodies: applications in clinical oncology, chapman and Hall Medical, London

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:

1) H.D.Kumar, Molecular Biology, 2nd edition, Vikas Publishing House Pvt. Lt.
2) Singer, M, and Berg.P – Genes and genomes, Blackwell Scientific Publication,Oxford,1991.
3) Beebe.T, and Burke. T,Gene Structure and Transcription, 2nd edition, 1992, Oxford Univ Press.

8th Semester

HSSM 4404 MARKETING MANAGEMENT (3-0-0)

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.

Marketing Environment : Socio-economic forces. Competition : national and global, Technology, Government Policy, Suppliers, Buyers, Consumer Resistance considerations. Environment scanning tools and techniques

Competition Analysis : Factors contributing to competition, Competition analysis tools, Competitive arena mapping, Segmentation matrix.

Market Planning : Exploring Opportunity, Product –market selection, Approaches to Market Planning, Market Planning Process.

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 Segmentation, Targeting and Positioning : Definition, Bases and Methods of segmenting consumer and Industrial markets. Target Market strategies: Domestic and global perspective. Market Positioning.

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)

Product Planning : Product Life Cycle, Locating products in PLC, New Product Development Process, Branding Strategy, Positioning a Brand, Brand Equity, Packaging and Labeling, Product-mix and Product Line, Product-Mix strategies, Planned Obsolescence.

Pricing Decision : Objectives and Factors influencing pricing, Cost-Plus Pricing, Breakeven Analysis, Price Based on Marginal Analysis, Price Elasticity of Demand, Operating statement, Markups Analysis Ratios, Pricing Strategies : Market-Entry, Discounts and allowances, Geographic Pricing, Special Pricing.

Promotion Decisions : Marketing Communication and Promotion Process, Promotion Mix, Advertising : Media and Media selection process. Organising for advertising, sales promotion.

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.

Trends in Marketing : Global Marketing, Customer Services, Customer Relationship Management, Rural Marketing and Service Marketing.

References :

1. M. J. Etazel , B. J. Walker and W. J. Stanton, Marketing, Tata McGraw Hill, 13th Edition, 2004.

2. R. Saxena, “Marketing Management” Tata McGraw Hill, second Edition, 2003.

CPBT 8403 FOOD BIOTECHNOLOGY (3-1-0)

Module I **10 hours**

Preservation technology

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

Module II **10 hours**

Food Production technology

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

Module III **10 hours**

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 **10 hours**

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

1. Jay, Modern Food Microbilogy, CBS Publishers, 1987
2. Frazier, Food Microbiology
3. G.Reed,Prescott and Dunn’s Microbiology, CBS publishers, 1987
4. Desrosier,Teachnology of food preservation, CBS publishers

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 inventionlike 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

1) J.E.Smith-Biotechnology,3rd edition., 1996 Cambridge Univ. press.
2) Santaniello,Evenson, Ziberman, Carison-Agriculture and Intellectual Property Rights, Univ. Press, 1998
3) Thackerey,A (ed) – Private Science : Biotechnology and the Rise of the Molecular Sciences, Univ of Pennsylvania press, Phil, 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 moleues, structre function relationship of enzymes.

Module III **10 hours**

Physical methods such as X-ray crystallography, Laser roman Spectroscopy, mass spectroscophy, circular dichromism and optical roatory 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.
2) B.Alberts, D.bray, J.Lewis et al Molecular Biology of the Cell Garland Pub.NY.1983
3) Concepts in Biotechnology D.Balasubramaniam, Bryce, Dharmalingam, Green, Jayaraman Univ. press, 1996.

PEBT 8406 PROTEOMICS (3-0-0)

Module I **10 hours**

Introduction to protemics and protein engineering

- Protein prefractionation and sample preparation
- To 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
- SNIJRPS and introns
- Translation

Module IV **10 hours**

Protein folding

- hierarchic protein folding
- Defective protein folding
- Molecular chaperones
- The HSP 70 chaperone system
- Proteasomes, Prions, Polyketides and non-ribosomal peptides
- Combinational manipulation of polyketides and nonribosomal peptides

References

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

5) B.Alberts, D.bray, J.Lewis et al Molecular Biology of the Cell Garland Pub.NY.1983

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

Stochasitic 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, Netwton-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 Advances in biochemical engineering Vol21, A.Fiechts(ed) Spring-Vetlag, Berlin, 1 982.

3) J.E.bailey and D.F.Ollis, Biochemical Engg Fundamentals, 1986,McGraw Hill Book Company

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

Module I **10 hours**

Ecology & Biodiversity

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 – Prokearyotic & Eukaryotic organisms, General physical properties and Tolerance to environmental conditions; Microbial Biodiversity – strategies – bio-prospecting and recovery.

Module II **10 hours**

Air Pollution Control Methods and Equipment

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

Water pollution; sources and classification of pollutants, B.OD, C.O.D, D.O, T.D.S, Oil and grease, Metals etc. Standards, sampling and method of analysis, Bacteriological measurements. Overview of treatment principles and theory of aeration, Municipal Sewer and Industrial Wastewater Treatment-Principles, operation and design aspects of: Activated Sludge process, Extended Aeration, Nitrification-denitrification. Trickling Filter, Mechanically aerated logoons, Concepts of Waste stabilization ponds, Aquatic plant systems, Ranking of waste water treatment processes, common effluent treatment plant.

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
2. Metcalf & Eddy, Wastewater Engineering – Treatment, Disposal and Reuse, 3rd ed., Tata McGrawhill
3. Rao, C.S.,Environmental Pollution Control Engineering, New Age International, 1999.
4. Arceiwala, S.J., Wastewater treatment for pollution control, 2nd Ed. TMH.

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.
   - Working capital assessment, Balance Sheet, Costing, Book keeping.
   - 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
2. Management of Small Scale Industry, Vasant Desai, Himalaya Pub. House