National Institute of Technology , Raipur (C.G.)

Course of Study & Scheme of Examination — B. Tech. VIII Semester — Branch: Biotechnology

S.No.	Board of Studies	Sub. Code	Subject Name	Periods/week				Examination Scheme				Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	ESE	Prac. ESE		
1	Biotechnology	BT 20811 BT	Metobolic Engineering	3	1	-	20	15	15	70	-	120	4
2	Biotechnology	BT 20812 BT	Environmental Biotechnology	3	1	-	20	15	15	70	-	120	4
3	Biotechnology	BT 2083* BT	Elective I	3	1	-	20	15	15	70	-	120	4
4	Biotechnology	BT 2087# BT	Elective II	4	1	-	20	15	15	70	-	120	5
5	Biotechnology	BT 20821 BT	Metobolic Engineering Lab	-	-	2	30	-	-	-	20	50	2
6	Biotechnology	BT 20822 BT	Environmental Biotechnology Lab	-	-	2	30	-	-	-	20	50	2
7			Major Project	-	-	16	100	-	-	-	100	200	8
8			Discipline	-	-	-	50	-	-	-	-	50	2
			Total	13	4	20	290	60	60	280	140	830	31

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ultimately in the following format which will be included in the semester mark-sheets.

* Subject code for Elective I

Subject code for Elective II

Format for attendance			
Attendance			Category
> 85		----->	High "H"
> 70 & < 85		----->	Medium "M"
> 60 & < 70		----->	Low "L"
< 60		----->	Detained " D "

Chairman (BOS)

Member (BOS)

Member (BOS)

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Environmental Biotechnology	Subject Code	BT 20812BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
03	01	02	4+2

Unit 1: Introduction to Environment:
Components of environment, Concept of Ecology and Ecosystem. Environmental pollution; water, soil and air. Noise and Thermal pollution; their sources and effect.

Unit 2: Waste Water Management:
Waste water characterizations; physical, chemical and biological, Waste water treatment processes: Screening, Mixing, Flocculation, Sedimentation, Floatation, Granular medium operation, Filters, Chemical precipitation, Biological treatment, Oxidation pond Aerated lagoon, Trickling filters, Activated sludge, Sludge digestion, Anaerobic filters, Anaerobic pond, Adsorption, Ion exchange, Chlorination, Reverse osmosis.

Unit 3: **Solid Waste Management**:
Solid wastes, Types of solid waste(Recyclable, Non Recyclable, Biological etc.), Collection and disposal methods of solid waste, different treatment methods available for solid wastes, Advantage and disadvantage of treatment methods.

Unit 4: Bioremediation
Bioremediation, Phytoremediation, Development of stress tolerant plants, Use of Mycorryza for reforestation, Wormiculture technology, Solid waste; classification and Disposal method.

Unit 5: Microbial Applications in Environmental Biotechnology
Microbial leaching and mining. Introduction to Biofertilizer, Biopesticides, Bioinsecticide and Bioherbicide. Xenobiotics: Introduction and Degradation of Xenobiotic compounds.

Text Books:

1. A Text book on Environmental pollution and control- Dr. H.S. Bhatia.
2. Environmental Biotechnology by Alan Scrogg(1999) : Langman
3. Foster C.F,John ware D.A., "Environmental Biotechnology",Ellis Horwood, Ltd;1987.

.

Reference Books:

1. Wastewater Engineering- Treatment and reuse, Metcalf Eddy ,Tata McGraw Hill.
2. Environmental Engineering G.M.Pandey and G.C.Carney, Tata McGraw Hill.

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Metabolic Engineering	Subject Code	BT 20811BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
03	01	02	4+2

Unit 1: Introduction
Induction – Jocob monad model, Catabolite regulation, glucose effect, comp deficiency, feed back regulation, regulation in branched pathway, differential regulation by enzymes, concerted feed back, regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, energy charge, permeability control passive diffusion, facilitated diffusion, active transport group transportation.

Unit 2:Introduction to Trophophase:
Synthesis of primary metabolites – Alteration of feed back regulation, limiting accumulation of end products, feed back, resistant mutant, alteration of permeability.

Unit 3: Introduction to Idiophase:
Biosynthesis of secondary metabolites: precursor effect, prophosphase, idiophase relationships, enzyme induction, feed back regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

Unit 4: Bioconversions:
Advantage of bioconversions, specificity yields, factors important to bioconversions regulation of enzyme synthesis, mutation permeability Co-metabolism, avoidance of product inhibition, mixed or sequential bioconversions, conversions of insoluble substances.

Unit 5: Regulation of enzyme production :
Strain selection improving fermentation, recognizing growth cycle peak, induction, feed back repression, catabolite repression mutonts resistance to repression, gene dosage.

Name of Text Books:
1. Biotechnology by B.D Singh, Kalyani Publishers
2. Wong O.I.C., Cooney C.L. Demain A. L. Dunnil P. Humphrey A. E., Lilhy M.D., fermentation & enzyme technology, John Wiles & Sons, 1980.

Name of Reference Books:
1. Stonbury P. F. & whitakar A. Principles of formentation Technology, Rergamon press,

1984.
2. Zubay G., Biochemistry, Macmillan Publishers, 1989.

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Molecular Modeling & Drug Designing	Subject Code	BT 20832BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
03	01	00	04

Unit 1- Imperial Force fields molecular mechanism : Bond Stretching – Angle Bending – Torsional terms – Out plane bonding motions – Electrostatic interactions – Van Der Waals interactions – Effective pair Potentials – Hydrogen Bonding – Simulation of liquid water

Unit 2- Computer simulation methods: Calculation of thermodynamic properties – Phase space – Practical aspects pf computer simulation – Boundaries monitoring Equilibrium – Long range Process – Analyzing result of simulation and estimating errors

Unit 3- Molecular dynamics: 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, Monte Carlo simulation methods.

Unit 4- Simulation Methods: Metropolis methods – Monte Carlo simulation of molecules – Monte Carlo simulation of polymers – Calculating chemical potentials – Monte Carlo or Molecular Dynamics

Unit 5- Molecular modeling to discover and design new molecules: Molecular modeling in drug discovery – deriving and using 3D Pharma cores – Molecular docking – Structure Based methods to identify lead components- Denovo ligand design

Name of Text Books:

1. A.R Leach, Molecular Modeling Principles and Applications, Longman, 1996

2. J.M. Haile, Molecular Dynamics Simulation Elementary methods, , John Wiley and Sons, 1997

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Process Equipment & Bioreactor Designing	Subject Code	BT 20833BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
03	01	00	04

Unit 1- Design and operation of Novel Bioreactors: Batch Bioreactor, CSTR, Plug flow Reactor, Airlift, Packed bed, Bubble column, Fluidized bed, Tower Bioreactor, Photobioreactor.

Unit 2- Microbial Growth Kinetics: Growth of microorganism, Measurement of microbial growth, Kinetics of cell growth in Batch culture and in Continuous culture. Non ideal behavior. Modeling of Non-ideal behavior.

Unit 3- Product formation, Immobilized biocatalysts, Loss of activity, Effect of External diffusion limitation, Effect of Internal diffusion limitation, Yield, Mass Transfer coefficient, Mass transfer by diffusion; Theories of diffusional mass transfer, Rheology.

Unit 4: Enzyme reactor configurations: Batch growth of microorganism, Continuous culture of microorganism, Productivity, CSTR with recycle, CSTR in series, Oxygen rate transfer, Scale up, Scale down.

Unit 5: Flow measurement and control. Animal cell culture. Recombinant cell culture, Plant cell culture.

Text Books:

1. Principles of Fermentation Technology, second edition, by P.F.Stanbery, A. Witaker and S.J.Hall.
2. Biochemical Engg.Fundamentals-James F.Bailey, David F. Ollis(IInd) Mcgraw-Hill International Edditions.

Reference Books:

1. Process system analysis and control (IInd edition) Donald R. Coughnowr- McGraw Hill international edition.
2. Chemical Engineering Volume III, J.M. Coulson, J.F. Richardson Pergamon Press.

.

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Stem cell & Nano biotechnology	Subject Code	BT 20831 BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
03	01	00	4

Unit 1- Introduction: Introduction of stem cell biology, fate mapping of stem cells. Stem cell patterns. Cell Cycle control, checkpoints and stem cell biology. The drosophila ovary – an in vivo stem cell system.

Unit 2- Germ Line Stem Cells: Male germ line stem cells. Primordial germ cells as stem cells, embryonic stem cells, embryonic carcinoma cells as embryonic stem cell,

Unit 3- Hematopiotic stem cells: Repopulating patterns of primitive hematopiotic stem cell,molecular diversification and developmental interrelationship. Lymphopaisis and the problem of commitment verses plasticity.

Unit 4- Introduction to Nanobiotechnology: Historical prospective, Need for Nano size (Surface volume ratio Importance), Significance and key feature of Nano size, Comparison of particle behaviour at Nano size to Macro (Bulk) Size.

Unit 5- Nanostructure production & Applications: Bottom up and Top down approach for Nano particle synthesis , Chemical Methods for Nano Particle preparation e.g. Gold, Silver and Zinc oxide nanoparticle, Biofunctionalization of nano particles and nanotubes, Application of nanoparticles: Diagnosis, gene delivery system, cancer treatment and other application.

Text/Reference BookS-

[1] Stem cell Biology by Deniel R. Marshak, R.L. Gardner

[2] Bionanotechnology by E.S. Papazoglae and Aravind Parthasarathy

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Intellectual Property Rights	Subject Code	BT 20873BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
04	01		05

Unit I - Basic Concept of IPR
Basic Concepts of Intellectual Property: Introduction to intellectual property rights, laws and its Scope, Trade Related Aspects of Intellectual Property Rights.

Unit II - Patents
Patents: Introduction to patent law and condition for patentability, Procedure for obtaining patents, Rights of a patentee, Patent infringements, Biotechnology patents and patents on computer programs, Patents from an international perspective.

Unit III – Trademark & Geological Indications
Trademark and 'geographical Indications: Statutory authorities and registration procedure, Rights conferred by registration, Licensing, assignment and transfer of trademark rights, Trademark infringement, Geographical Indication of Goods & Appellations of Origin.

Unit IV - Copyright
Copyright: Registration procedure and copyright authorities, Assignment and transfer of copyright, copyright infringement and exceptions to infringement, Software copyright

Unit V – Law on Industrial Designs
Introduction to the law on Industrial Designs, Registration and piracy, International perspective, Introduction to the law on semiconductor layout design, Registration, commercial exploitation and infringement.

Text Books:

[1] Vinod V Sople ,Managing Intellectual Property, – PHI
[2] Kumar K ,Cyber law, intellectual property and e-commerce security, Dominent Publication and distribution, New Delhi.

Reference Books:

[1] Inventors Guide to Trademarks and Patents- Craig Fellenstein, Rachel Ralson- Pearson Education.

[2] Intellectual Property –David Bainbridge, Longman

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Project Planning Management & Evaluation	Subject Code	BT 20871BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
04	01	00	05

UNIT I
Identification of projects:
Generation and screening of idea, monitoring corporate appraisal, preparing project profiles and project rating index.

UNIT II
Feasibility studies:
Market and demand analysis, technical analysis, financial analysis and economic viability.

UNIT III
Project appraisal:
Criteria, net present value, internal rate of return, payback period and accounting rate of return method.

UNIT IV
Project management and implementation:
Project planning, project control, prerequisites of implementation. Network techniques of project management-Project evaluation and review technique (PERT) and critical path method (CPM).

UNIT V
Project review and control:
Initial review, performance evaluation, abandonment analysis and its behavioral issues.

Text books:
[1] Project planning, analysis, selection, implementation and review by Prasanna Chandra,TMH.

Reference Books:
[1] Project management-Dr. Harold Kerzner.
[2] Total Project management-Dr. P K Macmillan.

National Institute of Technology, Raipur (C.G.)

DEPARTMENT OF BIOTECHNOLOGY SYLLABUS

Name of the Subject	Proteomics	Subject Code	BT 20872BT
Semester	8th	Board of Studies	Biotechnology
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits L+P
04	01	00	05

Unit 1- Protein Structure Prediction: Primary structure and its determination, secendory structure prediction and determination of super-secondary structure and its domain in proteins, quaternary structure, methods to determine tertiary and quarternary structures, post transational modification. The proteome and genome, life and death of protein, Codon biasing & codon optimization.

Unit 2- Structure function relationship of proteins: DNA binding proteins, prokary otic and eukaryotic transcription factors, DNA Polymerases, Membrane protein and receptors, bacterial rhodophsin, epidermal growth factors, insulin and ODGF receptors and their interaction with effectors, protein phosphorylation, immunoglobulins, nucleotide binding proteins, enzyme serine proteases, ribonucleases, lysozyme.

Unit 3- Electrophoretic Analysis of Proteins: Two-dimensional polyacrylamide gel electrophoresis for proteome analysis: Brief history of 2-DE, 2-De with immobilized pH gradients, sample preparation, Solubilisation, reduction, The first dimension; IEF with IPG, Equilibration between dimensions, The second dimension: SDS-PAGE, resolution, reproducibility of 2-DE, outlook. Organic dyes and silver stains, Reverse stains, Colloidal dispersion stains, organic fluorophore stains, metal chelate stains.

Unit 4- Mass Spectroscopy Analysis of Protein: Background to mass spectrometry, Correlative mass spectrometric-based identification strategies, de novo sequencing using mass spectrometric data, separation methods for phosphorylation site analysis, present and future challenges and opportunities. Data acquisition, digital image processing, Protein spot detection and quantitation, gel matching, data analysis, data presentation, data bases.

Unit 5- New Approaches in Proteomics: Protein arrays, use of automated technologies to generate protein array and chips and the application of protein chips in proteomics. Mixing proteomes, protein expression profiling, identification of protein-protein interactions and protein complexes, mapping protein complexes, new approaches in proteomics.

Text / Reference Books:

1. Proteomics: from protein sequence to Function by S.R. Pennington and M.J. dunn. Viva Books. Private Limited (2001)
2. Introduction to Proteomics by Daniel C. Liebler. Humana Press
3. Moody PCE, and AJ Wilkinson, “Protein Engineering”, IRL press, Oxford, 1990
4. Branden C, Tooze R, “Introduction of protein structure”, Garland, 1993.