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Ph.D. Course work

Pre-Ph.D. Examination Syllabus

DEPARTMENT OF BIO-TECHNOLOGY,
K L UNIVERSITY,
VADDESWARAM - 522302, ANDHRA PRADESH, INDIA.

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List of Pre-Ph.D. Courses

DEPARTMENT OF BIOTECHNOLOGY

L-T-P-S: 3-0-0-0

S.No	Paper 1	Subject Code
1	RESEARCH METHODOLOGY	25RES101

S.NO	PAPER – 2	Code	PAPER – 3	Code
1	BIOANALYTICAL TECHNIQUES	25BT201	BIOPROCESS ENGINEERING	25BT202
2			MOLECULAR BIOLOGY & rDNA TECHNOLOGY	25BT203
3			MOLECULAR MODELLING AND DRUG DESIGN	25BT204
4			PLANT BIOTECHNOLOGY	25BT205
5			ENVIRONMENTAL BIOTECHNOLOGY	25BT206
6			MICROBIAL TECHNOLOGY	25BT207
7			BIOCHEMISTRY	25BT208
8			IMMUNOTECHNOLOGY	25BT209
9			NANOBIOTECHNOLOGY	25BT210
10			INDUSTRIAL BIOTECHNOLOGY	25BT211

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RESEARCH METHODOLOGY Code: 25 RES 101

UNIT I

Introduction: Definition and Objectives of Engineering Research, and Motivation in Engineering Research – Types of Engineering Research, Finding and Solving a Worthwhile Problem, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code. Reproducibility and replicability in research, FAIR data principles, open science practices.

UNIT II

Quantitative Methods for problem solving: Statistical Modeling and Analysis: Sampling, Characteristics of a good sample. Probability Sample, Simple Random Sample, Systematic Sample, Stratified Random Sample, Multistage sampling. Determining size of the sample, Practical considerations in sampling and sample size. Probability Distributions, Fundamentals of Statistical Analysis and Inference, Bayesian inference, Concepts of Correlation and Regression, Multivariate methods Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT III

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables, Relation between frequency distributions and other graphs, preparing data for analysis, Data Cleaning and Validation, Data Transformation and Feature Engineering, Interactive and Dynamic Visualizations.

UNIT IV

Soft Computing: Computer and its role in research, Use of statistical software SPSS, GRETL etc in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.

UNIT V

Structure and Components of Research Report, Types of Report, Layout of Research Report using Latex, Mechanism of writing a research report, referencing in academic writing. Abstracting, Bibliography.

Text Books

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006.
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047-0,2006.

Reference Books

1. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
2. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed[d].
3. Simulated Annealing: Theory and Applications (Mathematics and Its Applications, by P.J. van Laarhoven & E.H. Aarts[e].

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BIOANALYTICAL TECHNIQUES Code: 25BT201

UNIT I

Spectroscopy Techniques: Buffers, Methods of cell disintegration, Enzyme assays and controls, Detergents and membrane proteins, Dialysis, Ultrafiltration and other membrane techniques UV, Visible and Raman Spectroscopy, Theory and application of Circular Dichroism, Fluorescence, MS, NMR, PMR, ESR and Plasma Emission spectroscopy.

UNIT II

Chromatography Techniques: TLC and Paper chromatography, Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography, HPLC and FPLC, Criteria of protein purity.

UNIT III

Electrophoretic techniques: Theory and application of Polyacrylamide and Agarose gel electrophoresis, Capillary electrophoresis, 2D Electrophoresis, Disc gel electrophoresis, Gradient electrophoresis, Pulsed field gel electrophoresis.

UNIT IV

Centrifugation: Basic principles, Mathematics & theory (RCF, Sedimentation coefficient etc), Types of centrifuge - Micro centrifuge, High speed & Ultracentrifuges, Preparative centrifugation, Differential & density gradient centrifugation, Applications (Isolation of cell components), Analytical centrifugation, Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods.

UNIT V

Advanced Techniques: Protein crystallization, Theory and methods, API-electrospray and MALDI-TOF, Mass spectrometry, Enzyme and cell immobilization techniques, DNA & Peptide Synthesis and sequencing.

Text books

1. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman & Company, San Fransisco, 1982.
2. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000.

Reference books

1. D. Holme & H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998.
2. R. Scopes, Protein Purification - Principles & Practices, 3rd Edition, Springer Verlag 1994.

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BIOPROCESS ENGINEERING Code: 25BT202

UNIT I

Introduction to Bioprocess: An of overview of traditional and modern applications biotechnology industry, outline of an integrated bioprocess (upstream and downstream) with process flow sheet,steps in development of a complete bioprocess for commercial manufacture of recombinant-DNA derived product.

UNIT II

Dimensions and system units: Basic Biochemical Calculations: atomic, molecular and equivalent weights. Molarity, Molality, Normality and partial pressures, laws of chemical combination, Definition of stoichiometry, Composition of mixtures and solutions, weight fractions, volumetric composition, Density and Specific gravity.

UNIT III

Fermentation and Enzyme Processes: Aerobic and Anaerobic fermentation processes and their application in the biotechnology industry behavior of microbes in different reactors (air lift, batch, continuous, fed batch condition). Production of enzymes in submerged and solid-state processes, extraction and purification of enzymes, methods of characterization, specific activity and activity definitions.

UNIT IV

Metabolic Stoichiometry and Energetics: Stoichiometry of cell growh and product formation, Elemental balances, degree of reduction of substrate and biomass. available electron balance, yield coefficients of biomass and product formation, maintenance coefficients, Energetic analysis of microbial growth and product formation, thermodynamic efficiency of growth.

UNIT V

Kinetics of microbial growth and Product formation: Phases of cell growth in batch cultures, Simple unstructured kinetic models for microbial growth, Monod model, Growth of filamentous organisms. Growth associated (primary) and non-growth associated (secondary) product formation Kinetics. Leudeking-Piret models.

Text Books

1. D.G.Rao, Introduction to Biochemical Engineering, McGraw-Hill, 2005.
2. Pauline and Doran , Bio Process Engineering Principles , Elsevier.

Reference Books

1. Bailey Ollis, Biochemical Engineering fundamentals, 2nd edition, McGraw-Hill, 1986.
2. M.L.Shuler and F. kargi Bioprocess engineering, Prentice Hall of India 1992.

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MOLECULAR BIOLOGY & rDNA TECHNOLOGY Code: 25BT203

UNIT I

Eukaryotic chromosome Structure, DNA Structure, Genes arrangement, Prokaryotic and Eukaryotic replication and repair. Repetitive DNA. CpG islands. Different classes of RNA and their functions. Prokaryotic and Eukaryotic Transcription and post transcriptional modifications.

UNIT II

Protein synthesis and translational control, Control of gene expression in prokaryotes. Transcriptional control in Eukaryotes. Transposable elements and TY elements. Molecular mechanism of antisense molecules, Biochemistry of ribozyrne, Applications of antisense and ribozyme technologies.

UNIT III

Nucleic Acid Purification, Yield Analysis, Nucleic Acid Amplification and Its Applications. Nucleic Acid Sequencing. Restriction enzymes, ligases, s1 nuclease, terminal deoxynucleotides, transferases, Poly A polymerases, Reverse Transcriptase, Alkaline phosphatase. DNA and RNA markers. Restriction Mapping of DNA Fragments and Map Construction.

UNIT IV

Gene Cloning Vectors, Plasmids, phagemids, cosmids, Artificial chromosomes. cDNA Synthesis and cDNA library preparations. Cloning mRNA enrichment, reverse transcription, DNA primers, Linkers, adaptors, Library construction and screening. Genomic libraries (complete sequencing projects). Alternative Strategies of Gene Cloning, Cloning interacting genes- Two-and three hybrid systems, cloning differentially expressed genes. Site-directed Mutagenesis and Protein Engineering.

UNIT V

DNA transfection, Southern and Northern blot, Primer extension, S1 mapping, RNase protection assay, Reporter assays. Nucleic acid microarrays. Vector engineering and codon optimization, host engineering. In-vitro transcription and translation, Expression Strategies for Heterologous Genes in Bacteria, Yeast and mammalian cells. Processing of Recombinant Proteins, Purification and refolding. Phage Display, Transgenic and Gene Knockout Technologies, Targeted gene replacement, Chromosome engineering. Gene Therapy Vector engineering. Strategies of gene delivery, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing.

Text Books

1. Molecular Biology of the gene by Waston et al 4th ed.“Genes VI” by Benjamin Lewis.
2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
3. DNA Cloning: a Practical Approach, .M. Glover and B.D. Hames, IRL Press, Oxford, 1995.

Reference Books

1. DNA Science. A First Course in Recombinant Technology, D,A. Mickloss and G.A. Froyer. Cold Spring Harbor Laboratory Press, New YorK, 1990.
2. Molecular Biotechnology (2nd Edn.), S.B. Primrose. Blackwell Scientific Publishers, Oxford, 1994.

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MOLECULAR MODELING AND DRUG DESIGN Code: 25BT204

UNIT I

Introduction to Molecular Modeling: History of molecular modeling, physical and computer models, different representations of computer models, Generation of 3D coordinates–using x-ray crystallographic databases, compilation of fragment libraries with standard geometrics, drawing of 2D structures using sketch.

UNIT II

Basic concepts of Protein Modeling: Concepts of Force Fields, Quantum and Molecular mechanical force fields, Generation of potential energy surfaces, Geometry Optimization, Energy-Minimizing Procedure, and Use of Charges. Salvation Effects, Methods, Ab initio Methods, Semi-empirical Molecular Orbital Methods, Conformational Analysis.

UNIT III

Protein Structure predictions: Basic principles of secondary structure prediction methods, Algorithms of Chou Fasman, GOR, PHD, PSI-PRED, Stereo-chemical method of Lim and Neural network method, concepts in measuring the accuracy of predictions.

UNIT III

Protein structure elucidation: Steps involved in Homology Modeling. Fold Recognition and ab-initio methods, Derivation and significance of Ramachandran Plot, Root Mean Square Deviation (RMSD), Energy Plot based on Potential of mean force, Packaging Quality, Helical Wheel, Hydrophobicity profiles, Amphiphilicity detection, Transmembrane prediction methods. Concepts in 3D structure comparison, purpose of structure comparison, Algorithms for structure comparison (FSSP, VAST & DALI), Structure-function relation, Function inference from structure.

UNIT V

Molecular modeling applications in drug designing: Identifying Putative Drug Targets and Potential Drug Leads: Starting Points for Virtual Screening and Docking Receptor Flexibility for Large-Scale Insilico Ligand Screens: Chances and Challenges, Molecular Docking.

Text Books

1. Molecular modeling basic principles and applications-Hans-Dieter Holtje and Folkers, Wiley 2003.
2. Molecular modeling of Proteins-edited by Andreas Kukol, Humana Press, Apr 2008
3. Introduction to Protein Architecture, Arthur M. Lesk,, Oxford University Press, 2001

Reference books

1. Molecular Modeling Principles and Applications- AR Leach, Longman, 1996.
2. Structural Bioinformatics, Edited by Philip E. Bourne and Helge Weissig, Wiley-Liss, 2003.

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PLANT BIOTECHNOLOGY **Code: 25BT205**

UNIT I

An Overview of Plant Biotechnology: Totipotency, Media, types of media used, media composition, nutritional variations, cell nutrition, cytodifferentiation, invitro growth parameters, contamination and recalcitrance, invitro cultivation methods, molecular farming.

UNIT 2

Organogenesis, Caulogenesis and Rhizogenesis: Descriptive understanding of invitro grown plantlets showing disease- resistant, herbicide tolerant and induction of environment sustainance. Direct and indirect methods of regeneration Suspension cultures, Somaclonal and gametoclonal variations and Genetic stability.

UNIT 3

Secondary Metabolite production & Germplasm conservation : Plant secondary metabolites, commercial production using appropriate media supplements viz., elicitors, growth factors, stress factors, defense proteins, precursors and anti-metabolites. Cryo preservation exsitu and insitu methods, freezing, thawing and drying and cryoprotectors.

UNIT 4

Genetic Transformation & Molecular breeding : Protoplast isolation, culture and fusion technique, protoplast induced transformation, Target cells for transformation, methods of gene transfer, selectable marker genes, reporter genes, screenable genes, Agrobacterium mediated transformation, histo chemical assay,transgenic plants, Plant DNA finger printing, RAPD, RFLP, PCR studies in plants with a focus on molecular assisted selection.

UNIT 5

Plant Bioinformatics: New approaches to scientific research with computers, Information and communication technologies (ICT model systems), genomics (functional and structural), proteomics, molecular bioinformatics, chemi-informatics and their applications in Plant improvement.

Text Books

1. Plant Cell, Tissue, and Organ culture" by J Reinert and Y P S Bajaj.
2. Plant Tissue Culture Theory and Applications Bhojwani SS and Razdan ,Elsevier Publication.
3. Introduction to Plant Biotechnology by H.S Chawla Second edition. Oxford & IBH Publishing Co.Pvt.Ltd.

Reference Books

1. Plant Biotechnology New Products and Applications. Hammond PM and Yusibov V .Springer International Edition. Plant Tissue Culture" Thorpe, T.A. (Ed.).
2. Handbook of Plant Cell Culture" Eds. Sharp et al. Plant Biotechnology" Eds. Mantell & Smith.

ENVIRONMENTAL BIOTECHNOLOGY Code: 25BT206

UNIT I

Fundamentals of Environmental Biotechnology: Scope and importance of environmental biotechnology, Ecology ecosystems and biodiversity, Biogeochemical cycles (C N P S cycles) and microbial roles, Types and sources of pollution – air water soil radioactive noise.

UNIT II

Wastewater Treatment and Bioremediation: Conventional and modern wastewater treatment technologies, Activated sludge process trickling filters UASB MBR SBR, Bioremediation principles in situ and ex situ methods, Microorganisms in biodegradation of hydrocarbons pesticides xenobiotics.

UNIT III

Solid Waste Management and Bioenergy: Composting vermicomposting anaerobic digestion, Biogas production and upgrading landfill leachate treatment, Microbial fuel cells biohydrogen bioethanol biodiesel, Waste-to-value recovery of resources from waste.

UNIT IV

Environmental Monitoring and Biosensors: Biotechnological tools for monitoring pollutants, Biosensors for heavy metals organics pathogens, Environmental genomics and metagenomics, Bioindicators and biomonitoring.

UNIT V

Advanced Applications and Climate Biotechnology: Phytoremediation mycoremediation rhizoremediation, Carbon capture and sequestration CCS algal CO_2 fixation, Biotechnological interventions for sustainable agriculture, Environmental risk assessment biosafety regulatory guidelines.

Text Books:

1. Scragg AH Environmental Biotechnology Oxford University Press 2005.
2. Evans G and Furlong J Environmental Biotechnology Wiley 2003.

Reference Books:

1. Rittmann BE and McCarty PL Environmental Biotechnology Principles and Applications McGraw-Hill 2001
2. Singh A and Ward OP Applied Environmental Biotechnology Springer 2004.

MICROBIAL TECHNOLOGY Code: 25BT207

UNIT I

Microbial Diversity: Tools and techniques of microbial diversity, culturables and non culturables, metagenomics.

Unit II

Screening and Strain improvement techniques: Primary and Secondary screening. Strain improvement by Physical, Chemical and Molecular techniques. Emerging techniques (genome shuffling etc), screening techniques, high throughput screening, food grade technologies, GMO (including labeling, release, identification), metabolic pathway engineering**.**

Unit III

Production of Primary Metabolites, Enzymes: A brief outline of processes for the production of some commercially important Organic acids (e.g., Citric acid, Lactic acid , Acetic acid, Gluconic acid), Amino acids (Glutamic Acid, Lysine, Aspartic Acid and Phenylalanine), and Alcohols (Ethanol, 2,3-butanediol) secondary metabolites: Antibiotics-beta-lactams (Penicillin's), aminoglycosides (Streptomycin), Macrolids (Erythromycin), Quinines and aromatics. Vitamin B12 and steroids, Enzymes.

UNIT IV

Production of Recombinant Proteins, Special bioproducts: Production of Recombinant Proteins-Insulin and Special Bioproducts- Biopesticides, Biofertilizers Natural Biopreservatives (Nisin), Biopolymers (Xanthan Gum, EPS), process of bioleaching, bioremediation, Probiotic and food applications.

UNIT V

Fermentation: Fermentation Microbial Growth and Death Kinetics, Media for Industrial Fermentation, media optimization, Air and Media Sterilization, Types of fermentation processes - Analysis of batch, Fed-batch and continuous bioreactions, bioreactors, specialized bioreactors (pulsed, fluidized, photobioreactors etc. Concept of SSF, down stream processing, product recovery.

Text Books

1. Molecular Biotechnology: Principles and Application of Recombinant DNA3rd edition,B.R. Glick & J.A. Pasternak, 2005.
2. Microbial Biotechnology, Glazer AN, Nikaido H, WH Freeman and Company, (1995).
3. General Microbiology, Stainer RY, Ingraham JL, Wheelis ML. & Painter PR. The Macmillan Press Ltd., (2000).
4. Microbiology-Principles and exploration, Black JG, Prentice Hall, (1999).

Reference Books

1. Microbial Biotechnology, Glazer AN, Nikaido H, WH Freeman and Company, (1995).
2. Biochemical Engineering Fundamentals (2nd ed), JE Baily & DF Ollis, McGraw Hill Book Co. New York. 1986.
3. Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm. 2000.
4. Principles of Fermentation Technology (2nd edition), PF Stanbury, A Whittaker and SJ Hall, Pergamon Press, Oxford. 1995

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BIOCHEMISTRY **Code: 25BT208**

UNIT I

Biomolecules and Structure: Amino acids peptides proteins, structure folding and function, Carbohydrates – classification stereoisomerism polysaccharides, Lipids, classification membrane lipids, sterols, prostaglandins, Nucleic acids – DNA RNA structure base-pairing supercoiling

UNIT II

Enzymology: Enzyme classification nomenclature cofactors isoenzymes, Enzyme kinetics, Michaelis-Menten Lineweaver-Burk plots, Allosteric regulation feedback inhibition ribozymes, Enzyme immobilization and industrial applications

UNIT III

Bioenergetics: Laws of thermodynamics, redox reactions, high-energy compounds, Glycolysis, gluconeogenesis glycogen metabolism, TCA cycle and amphibolic roles, Oxidative phosphorylation and chemiosmotic theory

UNIT IV

Metabolism of Lipids and Amino Acids: β-oxidation of fatty acids ketogenesis, biosynthesis of fatty acids, Amino acid degradation and biosynthesis, Urea cycle and nitrogen metabolism, Nucleotide metabolism (purines pyrimidines)

UNIT V

Advanced Topics: Vitamins coenzymes and trace elements in metabolism, Hormonal regulation of metabolism (insulin glucagon steroids), Signal transduction pathways (cAMP MAPK JAK-STAT), Biochemical basis of diseases – diabetes cancer metabolic disorders

Text Books

1. Nelson DL and Cox MM Lehninger Principles of Biochemistry WH Freeman 7th Edition 2017.
2. Voet D and Voet JG Biochemistry Wiley 4th Edition 2011.

Reference Books

1. Stryer L Biochemistry WH Freeman 8th Edition 2015.
2. Berg JM Tymoczko JL and Gatto G Biochemistry WH Freeman 8th Edition 2015.

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IMMUNOTECHNOLOGY Code: 25BT209

UNIT I

Basic immunology: Nature and Biology of antigens and super antigens. B & T cell antigens, Role of hapten and adjuvant in antibody and T cell response induction. BCR & TCR, antibody and its classes, Antibody diversity, MHC restriction, antigen processing and presentation.

UNIT II

Immune regulation and Effectors function: Cytokines and their role in immune regulation – T cell regulation. Cell - mediated cytotoxicity- Mechanism of T cell and NK cell mediated lysis. Antibody dependent cell mediated cytotoxicity (ADCC), macrophage mediated cytotoxicity. Immunomodulation – Induction, suppression.

UNIT III

Applied immunology: Hypersensitivity, inflammation, tissue necrosis, Autoimmunity, Transplantation. Immunological tolerance. Monoclonal antibodies, Antibody engineering, recombinant and chimeric antibodies. Abzymes and its applications. Principles and strategies for development of candidate vaccines.

UNIT IV

Tumor immunology: Basic feature of Normal and Cancer cell. Factors influencing the development of cancers - Chemical, Physical & Viral carcinogenesis. Types of tumors, metastasis – mechanism and control. Cell cycle regulation, Effect of cell receptors, Diet and cancer. Tumor suppressor gene products – p53, Rb. Cancer therapy -Chemotherapy, Radiotherapy, Immuno therapy.

UNIT V

Immunotechniques: Factors effecting the Ag-Ab reactions – Antigen-antibody interaction, EIA, FIA, RIA, Western blotting, FACS and tissue typing. Immunodiagnosis of infectious diseases. Recent advances in immunotechnology.

Text Books

1. Kuby Immunology, 5th Edition, -R.A. Goldsby, Thomas J. Kindt, Barbara, A.Osbarne.(Freeman).
2. Immunology-A short Course, 4th Edition, - Eli Benjamini, Richard Coico, Geoffrey Sunshine.(Wiley-Liss).

Reference Books

1. Margaret A Knowles and Peter. J. Shelly, Introduction to Molecular and Cellular Biology of Cancer. 4th Edition. Elsevier publications.
2. Abul K. Abbas K. Litchman, Jordan S. Pober. Cellular & Molecular immunology.

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NANOBIOTECHNOLOGY Code: 25BT210

UNIT I

Introduction to Nanobiotechnology: Definition scope and importance, Nanoscale materials quantum dots nanotubes nanowires nanoparticles, Nanobiotechnology vs nanomedicine.

UNIT II

Synthesis of Nanomaterials: Physical chemical and biological methods of nanoparticle synthesis, Top-down vs bottom-up approaches, Green synthesis using microbes plants and biomolecules, Surface modification and functionalization.

UNIT III

Characterization Techniques: SEM, TEM, AFM, STM, XRD, FTIR, Raman spectroscopy, DLS and zeta potential measurements, Surface plasmon resonance and fluorescence techniques.

UNIT IV

Applications in Biology and Medicine: Drug delivery systems nanocarriers liposomes dendrimers, Nano-biosensors for diagnostics, Imaging and therapeutic applications (MRI photothermal therapy), Nanotechnology in tissue engineering and regenerative medicine.

UNIT V

Environmental Ethical and Safety Issues: Nanomaterials in agriculture and food biotechnology, Nano-enabled remediation technologies, Toxicology of nanomaterials (nanotoxicology), Biosafety ethical implications and regulatory frameworks.

Text Books

1. Niemeyer CM and Mirkin CA Nanobiotechnology Concepts Applications and Perspectives.
2. Wiley-VCH 2004 Poole CP and Owens FJ Introduction to Nanotechnology Wiley 2003.

Reference Books

1. Bhushan B Springer Handbook of Nanotechnology Springer 2010.
2. Kumar CSSR Nanomaterials,Toxicity Safety and Risks Elsevier 2006.

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INDUSTRIAL BIOTECHNOLOGY Code: 25BT211

UNIT I

Fundamentals of Industrial Biotechnology: Scope and importance of industrial biotechnology, Microbial cell factories and industrial strains, Fermentation technology – overview and applications.

UNIT II

Production of Primary Metabolites, Organic acids (citric lactic acetic), Amino acids (lysine glutamate tryptophan), Alcohols (ethanol butanol).

UNIT III

Production of Secondary Metabolites, Antibiotics (penicillin streptomycin tetracycline), Vitamins (riboflavin B12), Steroids and alkaloids.

UNIT IV

Enzyme and Protein Engineering, Large-scale enzyme production (proteases amylases cellulases lipases), Immobilized enzymes and industrial biocatalysis, Protein engineering for improved stability and specificity, Recombinant proteins hormones vaccines monoclonal antibodies.

UNIT V

Industrial Bioprocess Applications, Food biotechnology fermented foods probiotics single-cell protein, Biofuels and renewable energy from biomass, Bioplastics and biodegradable polymers, Future trends synthetic biology CRISPR-based industrial applications.

Text Books

1. Clark JH Deswarte FEI and Farmer TJ Industrial Biotechnology Sustainability for Non-specialists Wiley 2009.
2. Casida LE Industrial Microbiology Wiley 1994.

Reference Books

1. Crueger W and Crueger A Biotechnology A Textbook of Industrial Microbiology Sinauer Associates 2000.
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